

Consulting Engineer

May 1960

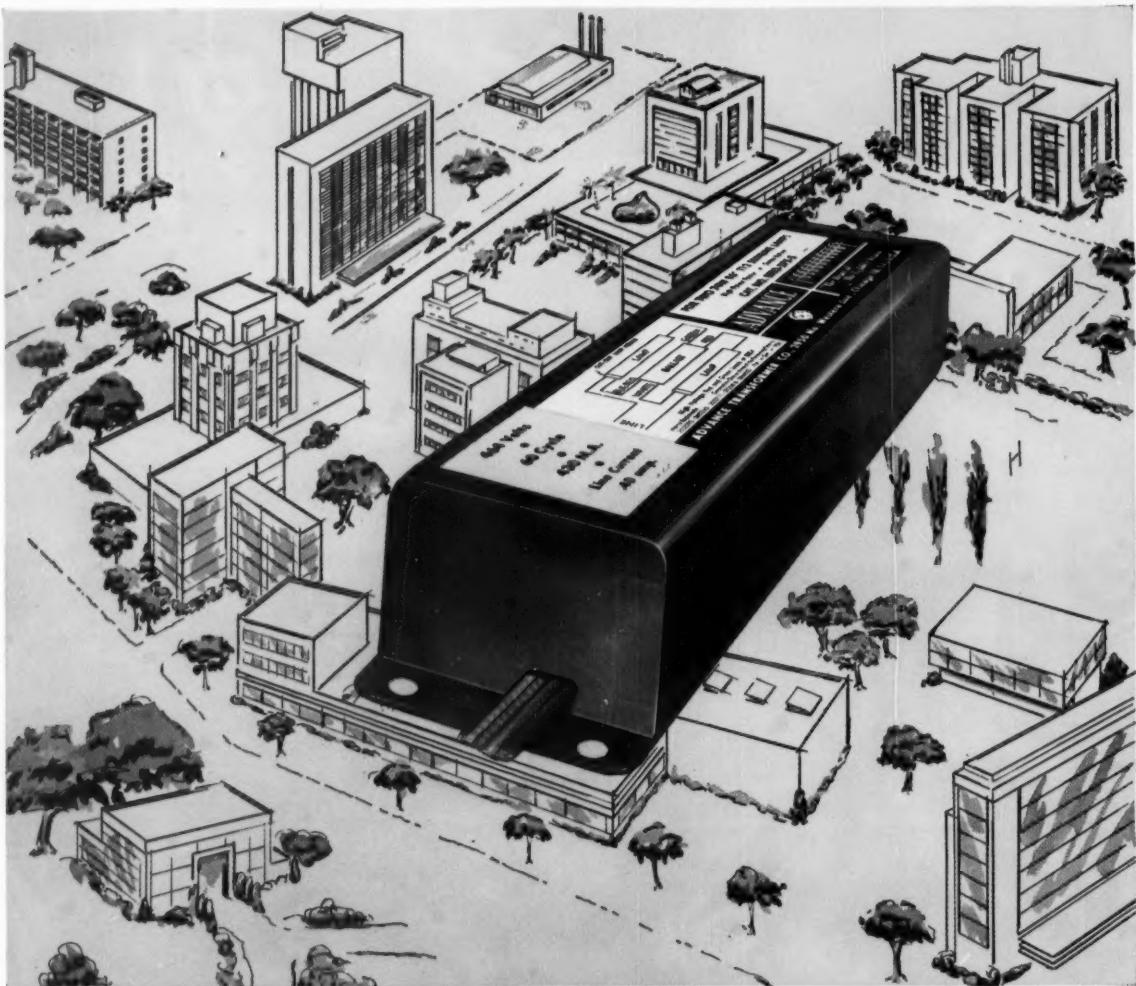
RICHARD H. TATLOW III, president of Abbott, Merkt & Company Inc., is the first president of the American

Institute of Consulting Engineers to come from an engineer-architect firm. Breaking tradition, however, is nothing new to Tatlow. His career has been a series of calculated risks, and his philosophy is expressed in his advice, "Never buy a round-trip ticket." It is not that he is afraid

Continued on Page 10



Photo by Fabian Bachrach



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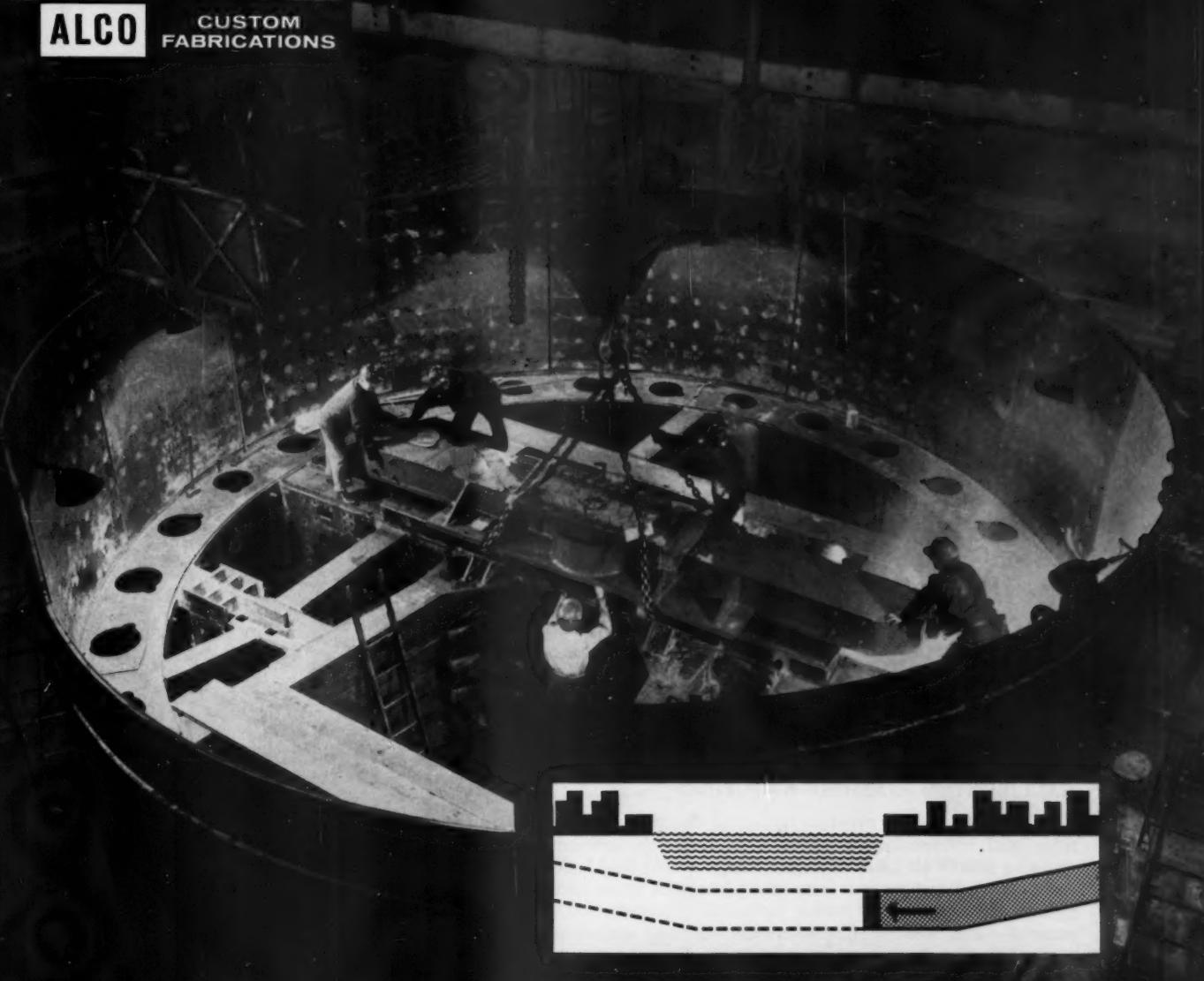
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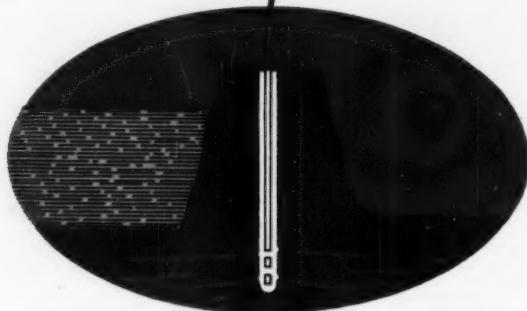
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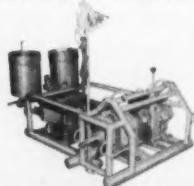


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MAY 1960 • VOLUME XIV • NUMBER V

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Imaginative Engineering Puts to Work on **DAYLIGHT**



Mike Best and Ed Kralovec, mechanical engineers on the Madonna school, shown discussing job details with two of their colleagues.

Kralovec & Best, consulting engineers, went one step further in their heat and ventilation design for the new Madonna High School, Chicago — they applied pneumatic control to skylight louvers.

To meet the lighting requirements of the combination auditorium-gymnasium, architect C. I. Krajewski used a system of sky domes equipped with adjustable light dampers. How to control the dampers quickly and efficiently for change-over from plenty of daylight for gym activities to total blackout for movies, etc., was the problem presented to the consulting engineer.

Kralovec & Best's solution was — twenty-nine 4-inch powerstroke piston damper motors — one for each of



Sky domes, inside and out. Each contains a set of light dampers, all of which operate simultaneously when darkness for movie showings is desired in the combination auditorium-gymnasium.

Powers Pneumatic Control



the sky dome louvers on the roof — energized instantly from a single Powers pneumatic selector switch in the projection room. Turning the switch activates air pressure at 15 psi. through a Powers Series 500 Pilot Valve to the motors to close the light louvers. When the switch is turned off, pressure is released . . . and the louvers swing open to admit light.

Pneumatic control of daylight in Madonna school is fast, easy and quiet — a definite convenience for the projectionist or instructors, an operational bargain for the school, maintenance-wise.

The complete heating system, as specified by Kralovec & Best, includes two hot water converters controlled at fixed temperatures. Individual classrooms are heated and ventilated by unit ventilators, controlled on the standard day-night cycle. Corridors, rest rooms, storage and locker rooms employ direct radiation controlled by Powers Day-Night room thermostats. For extra safety and comfort, hot water to all showers is controlled by means of a Powers Hydroguard Thermostatic Shower Control.

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Consulting Engineers:

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Chicago

Heating Contractor:

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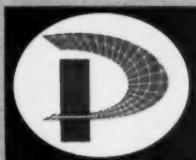
Chicago



A single pneumatic selector switch in the projection room actuates 29 sets of light louvers through 29 individual powerstroke motors.



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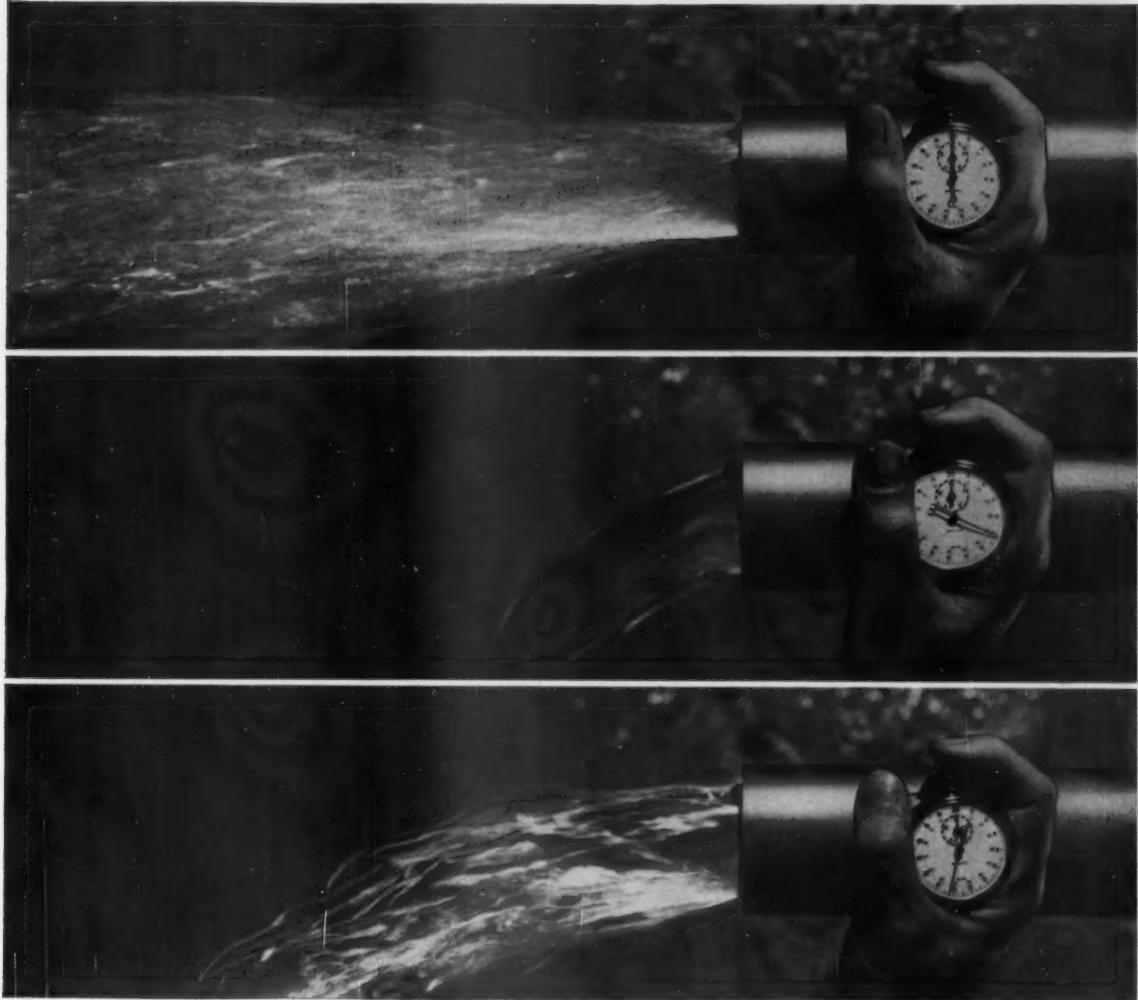
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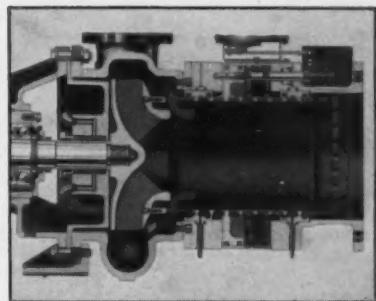
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Richard H. Tatlow III

— Starts on front cover

he will not get home. Instead, he simply assumes that the next step may be on to somewhere else rather than back to New York. "This habit of mine has been a profitable one," he says.

Early Background

The son of an inventor, banker, and manufacturer, Tatlow became interested in engineering when he was a boy following his father around the plant. "I did not have any particular idea of what I really wanted to do when I went to college, but I knew that engineering and machinery were my general fields of interest."

The summer before graduation from the University of Colorado, in 1927, Tatlow started looking for his first job. "Fortunately, the U. S. Bureau of Public Roads had just initiated a recruiting program. I was one of 17 chosen from as many universities to make up a Control Division." These young men were given careful training with the idea that they would become the future management of the Bureau. In order to compete with salaries offered by industry, these engineers were stationed officially in Washington, then provided with travel pay and benefits.

The only unfortunate thing about the plan was that it did not work. The Bureau had overlooked the fact that they would be dealing with a group of individualists, a majority of whom would not be likely to stay in government service.

Start in Consulting Field

Tatlow's entrance into the consulting field was the result of a *faux pas* he had made as a student. One day he wandered in to hear a speech being given by John Lyle Harrington, then president of the American Society of Mechanical Engineers and head of one of the country's most prominent consulting engineering firms — Harrington, Howard, and Ash, of Kansas City. Not realizing the prominence of the speaker, young Tatlow took advantage of the question and answer session to correct Harrington on several major points. Needless to say, Harrington remembered Tatlow and later wrote, inviting him to his office and offering him a job.

The internship of three years with the Bureau before being assigned to a district office was spent by Tatlow working in Texas, Utah, and California. In 1929, he received instructions to report to Omaha, Nebraska, and on his way he belatedly stopped by to see Harrington in Kansas City.

"Harrington offered me exactly one-third of what the Bureau was paying me on the basis that I had surely forgotten all I learned in col-

lege." Tatlow decided that if Harrington had the nerve to make an offer like that, he had the nerve to accept it.

Harrington Major Influence

In taking the job, Tatlow became a part of one of the country's most colorful consulting organizations, a firm specializing in bridge design. Formed in 1907, as Waddell & Harrington, this group was the forerunner of Howard, Needles, Tammen & Bergendoff, as well as other prominent firms.

In his student days, Tatlow always had said there were two things he would never do — work on a drafting board and live in the East. Harrington let him do both. "It was two years before I was let off the drafting board, and within five years I was living in Washington." But Tatlow had one advantage. When the depression came, his salary was so low they did not bother to fire him.

Harrington had an unusual approach to hard times. He was not afraid to gamble. He would select an area on the map, then let Tatlow go there to look for clients. "Go ahead, you can't hurt anything. We never had a client in that area," would be the cheerful send-off.

Career in Washington

About this time, President Hoover was organizing the Reconstruction Finance Corporation. He asked Harrington to be one of five prominent consulting engineers on the Engineers Advisory Board, and Tatlow volunteered to be office boy if Harrington would allow him to go along. Harrington agreed, and Tatlow, who had only been married one month, closed his apartment and was in Washington two days later. He never returned to live in Kansas City.

The work in Washington did not turn out to be in the office boy classification. Tatlow soon was writing summary reports, checking the feasibility of loans on engineering projects, and "learning about politics in a hurry." When Roosevelt was elected, to the presidency, Tatlow was asked to join the Public Works Administration.

About this time, Harrington asked Tatlow to open a Washington consulting engineering office for Harrington & Cortelyou, as the firm was now called. Tatlow agreed, and this office specialized in bridges and industrial projects. Among his jobs during this period were bridges over the Piscataqua, Missouri, Mississippi, and St. Johns rivers as well as docks, warehouses, and a sewage treatment plant. By 1940, when the first serious war rumors started, Tatlow's office had about \$40 million in bridges under contract.

A move was started by ex-officers of the First World War to organize a Construction Division for design and construction of Army facilities. Tat-

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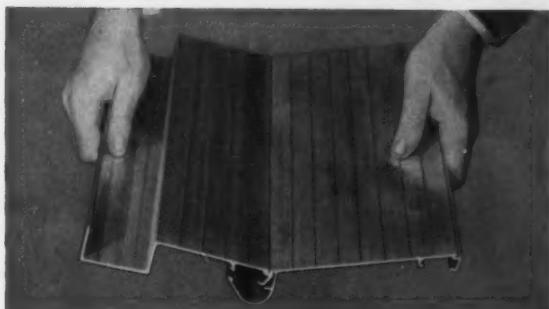
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Tatlow was named deputy director of the Division's engineering branch within the Quartermaster Corps.

Not long afterward, and still before war was declared, he became a member of the Construction Advisory Committee of the War Department. His job was recommending architects, engineers, and contractors, and also establishing a fee schedule — something many consultants would like to do now for the government.

"My theory was that while consulting engineers should not get rich on a war, they should be paid proper fees. Very few complained. The same fee curve, in principle, still is used today. The only real trouble was caused by the extremely low cost estimates which failed to anticipate the rapidly increasing costs."

Wartime Service

When war came, Tatlow was given a commission as a Lieutenant Colonel in the Corps of Engineers. His first job was to control the use of RFC monies in the building of defense plants. Never a believer in government offices for the sake of government offices, Tatlow was closing down some branch divisions even during the War.

Next he was sent to the staff of General Lucius Clay and placed in charge of industrial facilities, a job for which he later was awarded the Legion of Merit. He fell heir to Mobilization Day plans — literally acres of files supposedly listing all manufacturers who could be allocated contracts during wartime. Tatlow, who did not find the files to be overly accurate or current, promptly sent them to the Archives.

Joins Abbott, Merkt

Two deaths then shaped Tatlow's future career. Harrington's was the first. About the same time, O. L. Merkt died. Hunley Abbott and Merkt had tried several times previously to get Tatlow to join the firm, but he would not leave Harrington. So, after the War, Tatlow agreed to join Abbott, Merkt & Company Inc. as president.

The firm of Abbott, Merkt & Company, too, had a colorful history. In 1920, The George A. Fuller Company decided to become engineer-contractors, and Abbott was made vice president in charge of the engineering corporation. After trying this arrangement briefly, Fuller decided the contracting and engineering divisions would do better as separate organizations. Abbott elected to continue in consulting engineering, and in 1922, he and Merkt formed a firm specializing in the design of industrial buildings.

Today Abbott, Merkt & Company offers architectural, structural, civil, mechanical, electrical, and industrial engineering services. The firm is perhaps

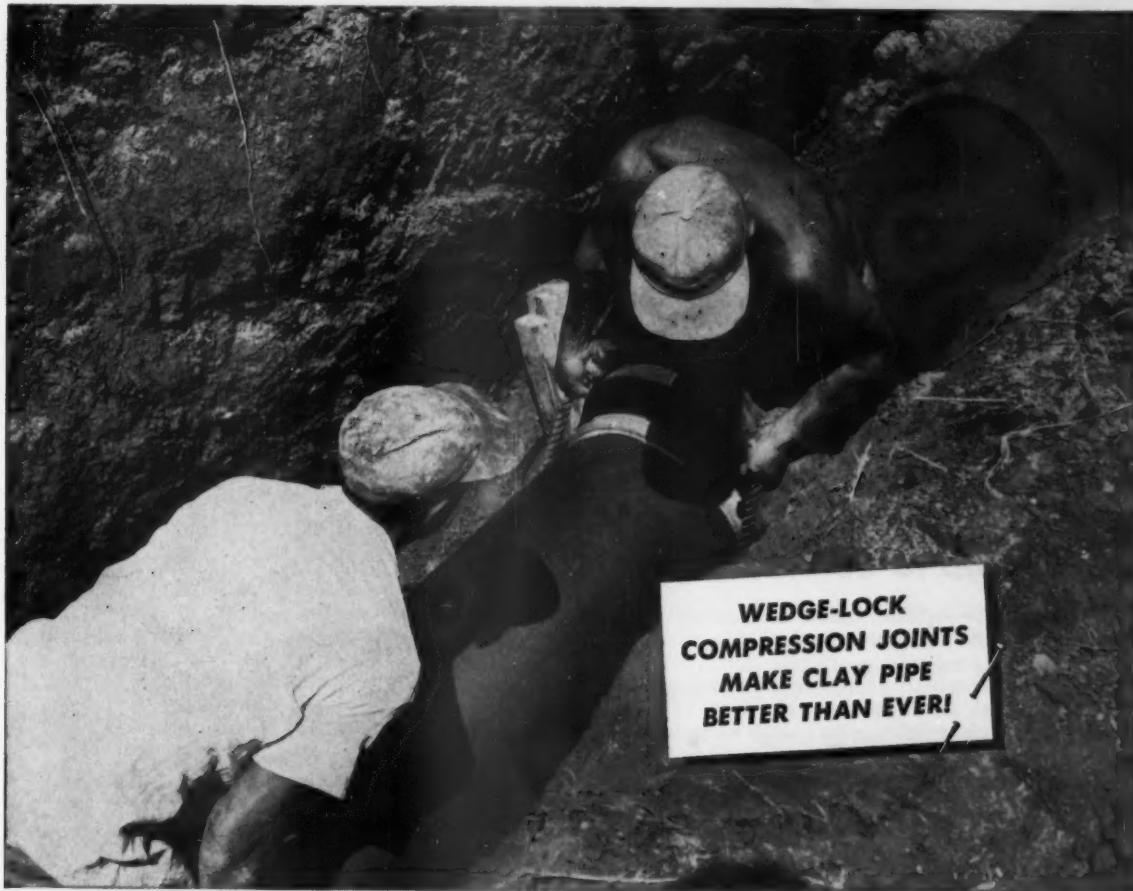
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A few years ago, Tatlow was given a slightly impossible sounding project — the design of a complete materials handling, receiving, and marking system for Macy's 34th Street store (the largest store in the world). The job was to be completed before the next Christmas season, and the store was to remain in operation during alterations. Abbott, Merkt met the deadline.

Then, just as the heavy Christmas rush was beginning, Tatlow got a telephone call. Macy's had one complaint about the conveyor system . . . "It doesn't work."

Tatlow and his men descended on Macy's. They figured and refigured everything. According to all calculations, the system *had* to work.

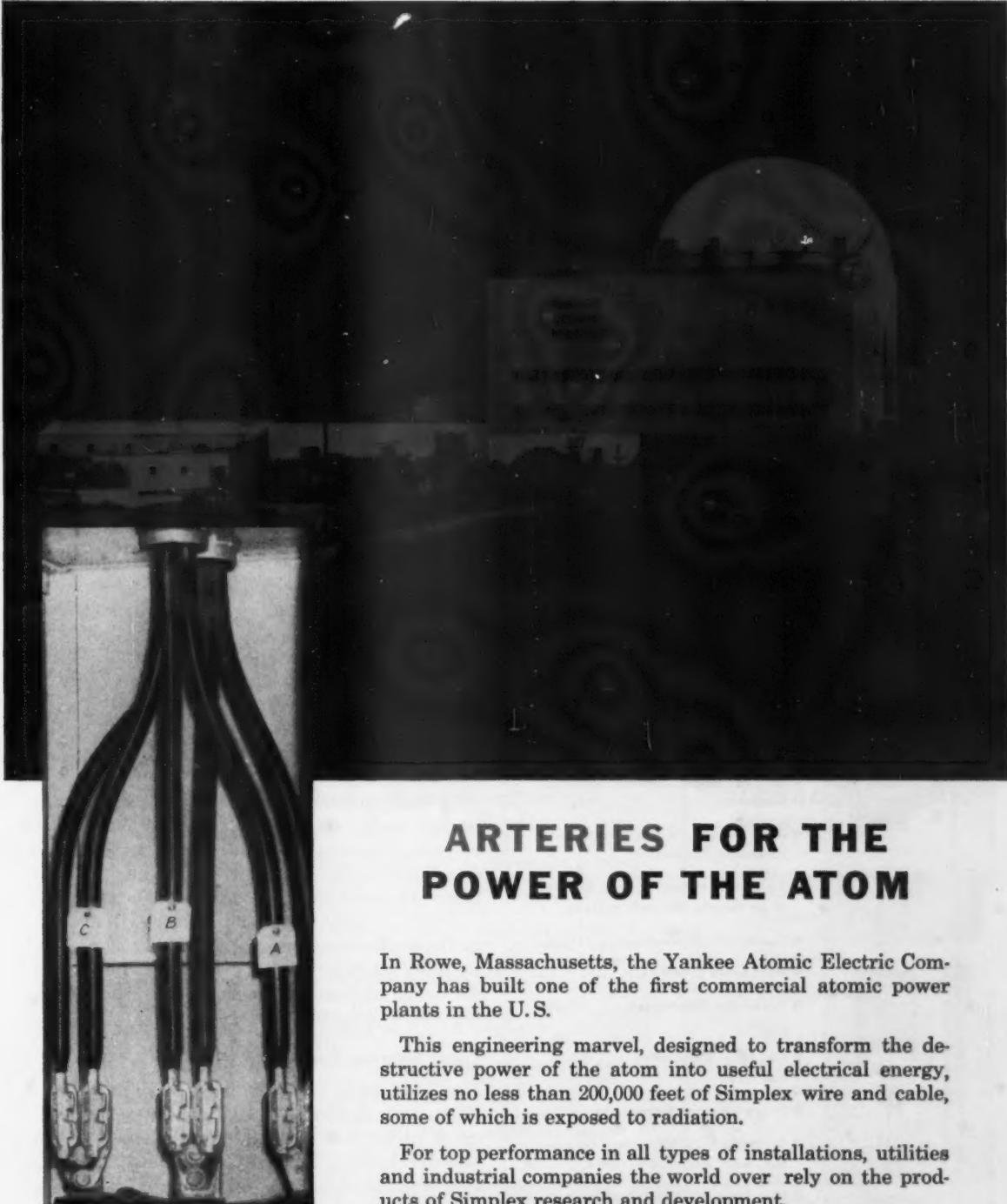
Finally the trouble was discovered. Tatlow's men followed the conveyors from beginning to end. At the very end sat a man who was having nothing to do with the new-fangled conveyors. Here all materials handling stopped. Merchandise piled up higher and higher, as the man sat and stared.

Everything was settled in the Christmas spirit, with the man being given an unexpected vacation. "After the Holidays, I received a call from Macy's saying they had enjoyed the easiest Christmas rush season in the store's history, the conveyor system worked flawlessly, and savings were even greater than expected."

Society Activities

Tatlow has been busy professionally, missing very few meetings of the American Society of Civil Engineers since he was graduated from college. He is a past president and board member of the Metropolitan Section. He also is vice chairman of the Building Research Advisory Board, and a member of the American Society of Mechanical Engineers, the Society of American Military Engineers, the Architectural League, and the Cosmos Club. Registered in 17 states and the District of Columbia, he also serves on the board of directors of the Nuclear Utility Services.

This year, under Tatlow's leadership, the American Institute of Consulting Engineers is taking an



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active interest in a number of problems affecting consulting engineers and their relationship with various branches of the government.

AICE Plans

Currently, the Institute is joining in the nationwide effort to combat reports issued recently by governmental agencies putting the consulting engineer in an unfavorable cost position. James P. Exum, committee chairman, is working with George S. Richardson, immediate past president of the Institute, to assure coordinated efforts in determining costs of design by government compared to costs of design by engineers in private practice.

Among the first organizations to draft an official reply to New York Senator Hughes' criticism of consulting engineers was the Institute, which offered to send a representative to any hearings the Senator might like to conduct. (Since the Senator is a one-man committee and has been under considerable fire recently, he is not likely to conduct any hearings.)

Tatlow also is worried about another phase of the government-consulting engineer relationship. When can a consultant tactfully hire engineers from government agencies without getting into possible conflict of interest situations, and also without raising cries of pirating.

The Institute president thinks some sort of rules of practice should be established, possibly through the cooperation of interested government, engineer, and architect groups.

Another question Tatlow would like to see studied by a joint group of organizations is that of package contracts. Is there some truth in the claim that engineering-construction firms can give better service to clients on certain projects?

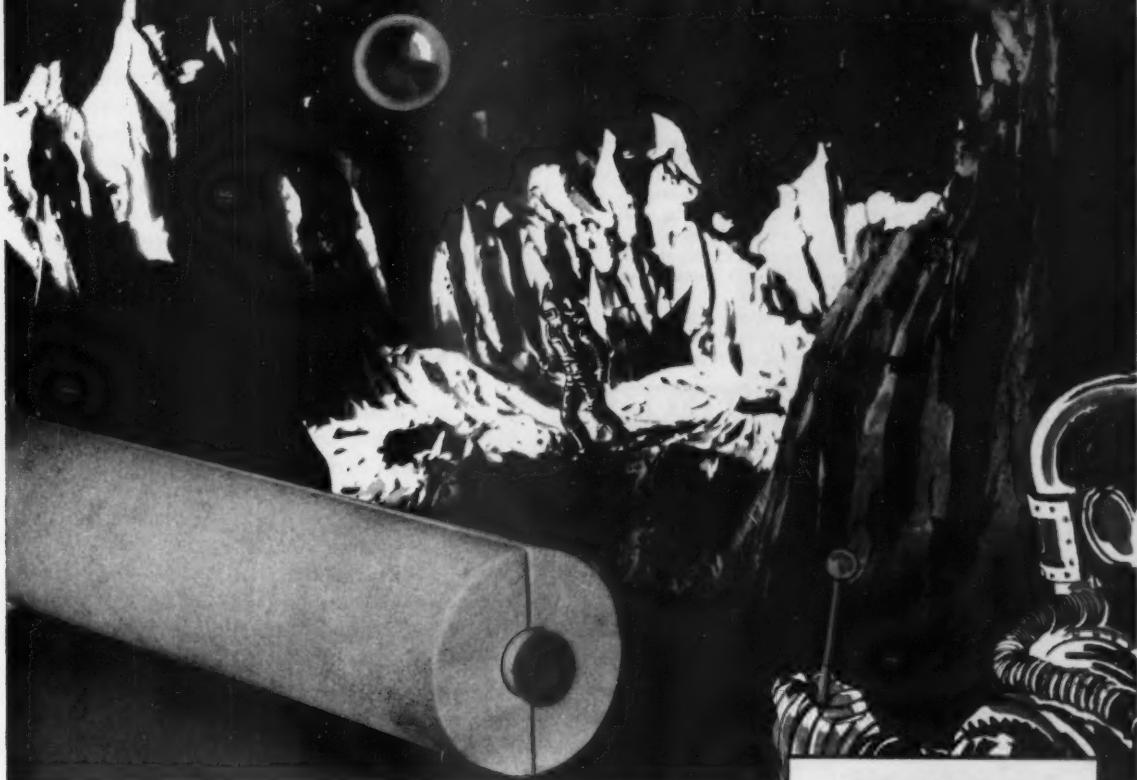
"I do not believe the owner receives full value or the lowest costs on most types of construction by using package contracts. If this is true, we in the design professions should advertise and inform the clients of the facts."

Local Sections Formed

The Institute now has initiated local sections in Boston and in Texas, and is making a continued effort to get a diversified membership. "We are now developing a standard Local Section Constitution, with the expectation that a number of sections will be formed," Tatlow added, and he hopes to see the Institute increase its membership without in any way lowering its admission standards.

What is the Institute's legislative committee doing these days? "We are not lobbying, and we do not intend to in the future. We also are not going to stand by and see our profession maligned. Right now, the legislative committee is keeping us in-

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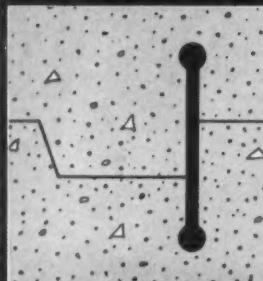
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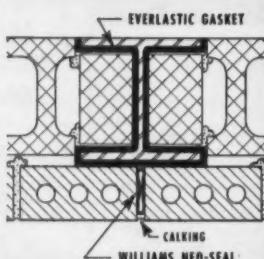
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formed of any legislation that might affect consultants, and this information is, in turn, acted upon promptly by the entire group."

Feeling on Business Practices

The Institute, some time ago, adopted a policy that would recognize the practice of engineering by corporations, provided control of the corporation remains in the hands of registered engineers. Tatlow was asked if he feels being incorporated has made much of a difference in the profit life of his firm. "I do not think being incorporated is an advantage or a disadvantage. As a matter of fact, several times we have discussed the possibility of becoming a partnership. As things now stand, we are taxed once on the corporate income, then taxed again on the individual income."

Tatlow has a definite business philosophy: "We at Abbott, Merkt & Company, have insisted upon giving more than bare requirements to our clients, regardless of financial consequences to ourselves. We will not accept an engagement unless we sincerely believe that we can do a fine job.

"An owner should always be given cost estimates as early as possible. We believe in giving him a 'horseback' guess at the time of employment, then following this with monthly reports, except where no change takes place, as in the early preliminaries. 'Costs' must include all items the owner must pay or make allowances for — land, surveys, borings, engineer's reimbursables, contingencies, interest, equipment furnished by the owner, legal and administrative costs . . . Comprehensive change order procedures are essential, with complete controls, so the owner can make decisions before — rather than after — commitment."

As for fees, "I believe the percentage fee is basically wrong and unfair to the owner and the engineer. We in Abbott, Merkt & Company have been using a fixed fee to which is added our direct technical payroll plus an allowance to cover overhead. This entire fee may then have a maximum limit, based, for example, upon a dollar amount per square foot of building. In addition to the fee, we are reimbursed for the usual items of reproductions, models, telephones, travel, subsistence during travel, and 1.2 times the salary of our resident engineer. This form of agreement has much merit for all concerned and, in my opinion, could well be adopted by all consulting engineers."

Tatlow's Abbott, Merkt & Company also is a member of JANUS Engineering Designs — a joint venture with Kahn and Jacobs; and Howard, Needles, Tammen & Bergendoff. The group, which has a consulting board of scientists, currently is handling a 25,000-acre industrial development near Fort Lauderdale, Florida, for Arvida Corp. □

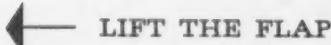


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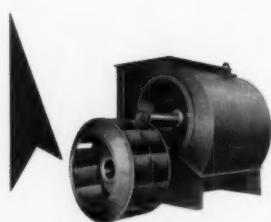
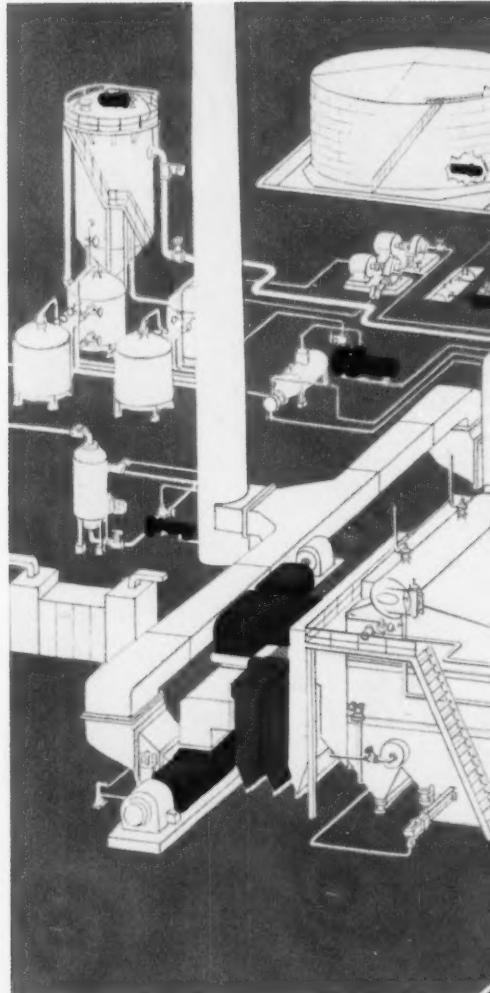
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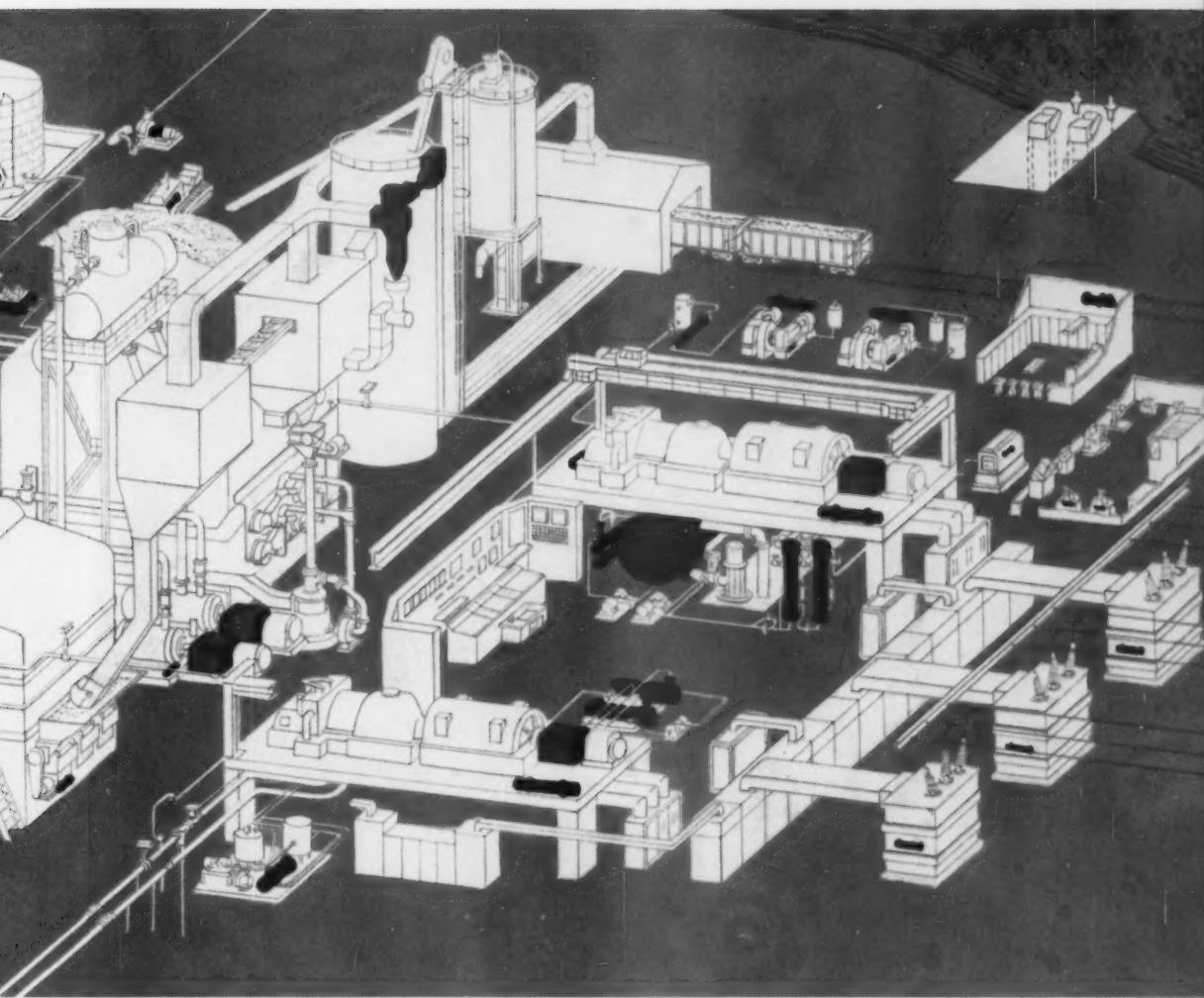


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Dust and Fly Ash Collector

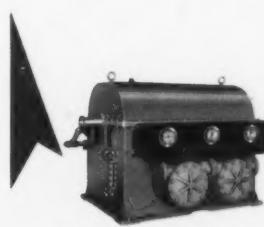
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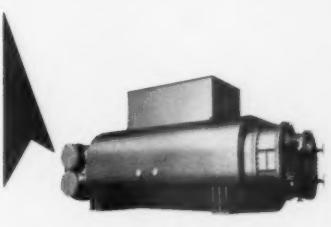
...e's where some of American-Standard Industrial Division products serve in a modern power plant.



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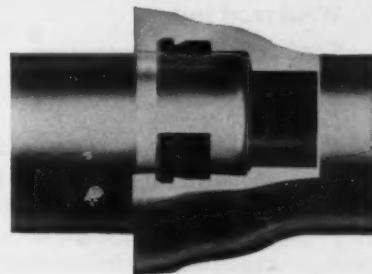
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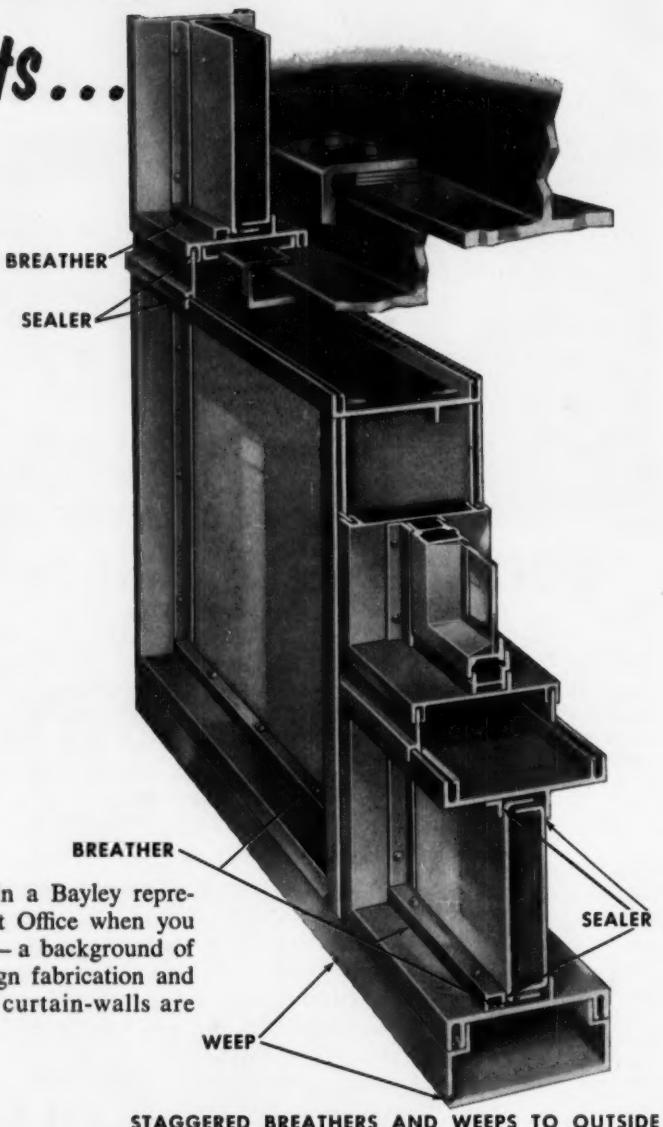
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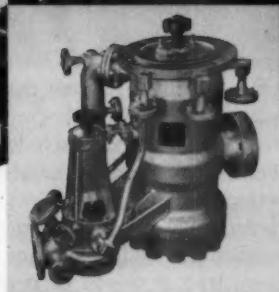
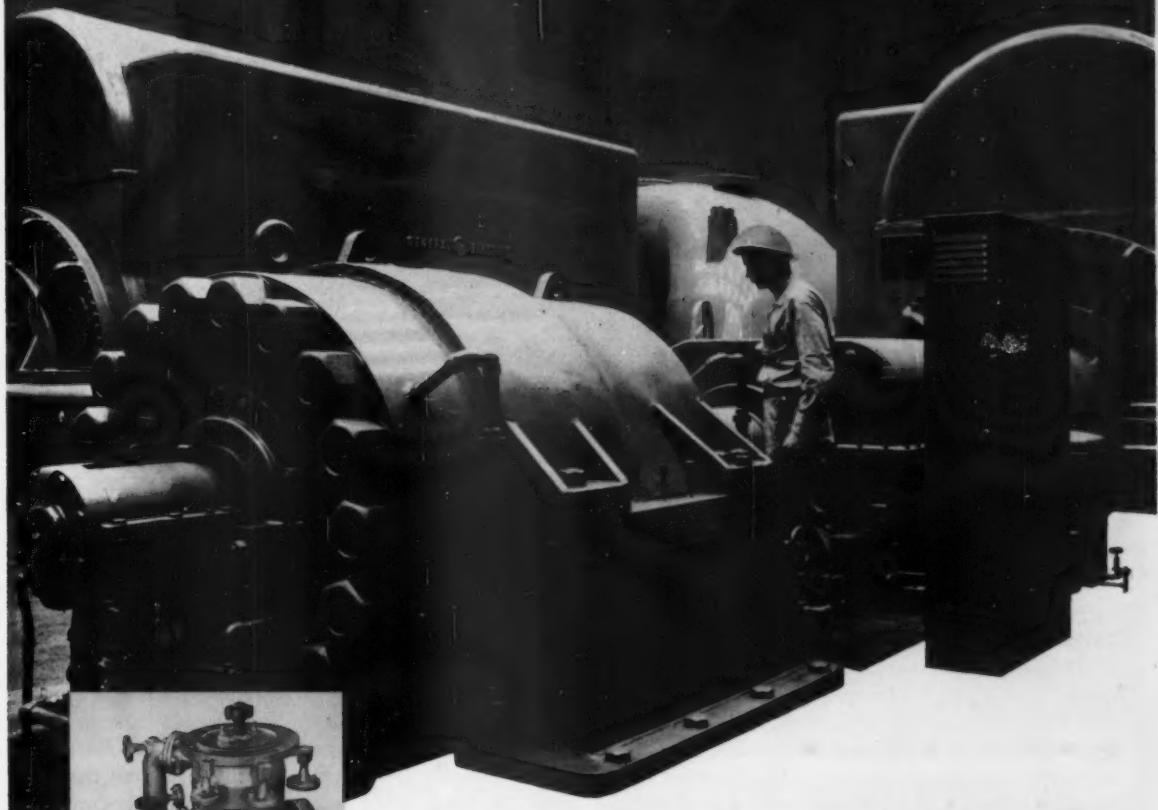
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From the Editor's

Tranquil Tower

Guiding our Government

WE ARE WATCHING the stepped-up Washington activity of the Consulting Engineers Council. CEC has been tippy-toeing up and down Washington corridors for several years, meeting with the government's great middle-class and listening to the usual expressions of sympathy and the familiar pledges of allegiance to private enterprise. The results, however, have always toted up to a great big fat zero. While the players in this amateur production have changed from time to time, and while no one has been able to quite carry off the lead, it should be noted that some experience has been gained, and recent presentations (with exceptions) have a more professional and polished air. It is even said that there are real professionals working backstage and prompting from the pit.

We are supporters of any honest and respectable means toward that excellent end of more private and less government engineering. We agree that it is necessary to have experienced and intelligent representatives on the scene in Washington. Constant surveillance of legislative activity and regular testimony by authorities supplied with current data is essential. CEC, NCPE, and EJC all need that type of thing. More and more and better and better is the only proper attitude toward these political activities. Go right to it, we say. We will award a certificate of merit to the first to ride down the Capitol steps with no hands.

What really worries us is the growth of an ugly aspect of this otherwise estimable desire to influence government. It is the feeling of some that the success of a program depends entirely upon the amount of money available to pour into it. The implication is that it is easy to buy whatever is desired in the way of legislation. Every bill and every public servant, according to this philosophy, has a price. This is simply not so. There may be rare and revolting exceptions, but you cannot buy the support of Congressmen for so many dollars. Nor are top

men in the administrative offices for sale at so much a head.

Consulting Engineers Council knows this, and we are positive that the Council has never thought of trying to buy government support either directly or indirectly. In fact, their latest appeal for funds was accompanied by a rather full explanation of the general areas in which the money collected will be spent, though this could in no sense be called an accounting.

The fact is that all money collected by Consulting Engineers Council will be used, we feel sure, to put before the right representatives and officials data to support the proper claim of engineers in private practice that they can perform engineering services at a lower cost than can government employee engineers. This is a legitimate and much needed effort, and it will cost money. It is a pity, that through lack of a full explanation early in the program, many have got the idea that this drive of the Council's is for some sort of slush fund that is to be used to "influence" important persons in Washington. There has been far too much loose talk along this line. Persons close to the program, who should know better, have dropped hints of influence gained by "favors" done for Congressmen.

The implication is ridiculous and a disgrace to the profession. If it were true, it would be revolting; as a lie, it proves nothing but the naivete of those who believe it. Consulting Engineers Council could not buy votes or gain influence through special favors if it wanted to — and it does not want to.

Simple as it sounds, one way to influence legislation, a way that works, is for local constituents to visit their own Representatives and Senators, and backed with factual data, truthfully presented, convince them of the righteousness of their position. Some organization of engineers ought to try it. It costs next to nothing. □□



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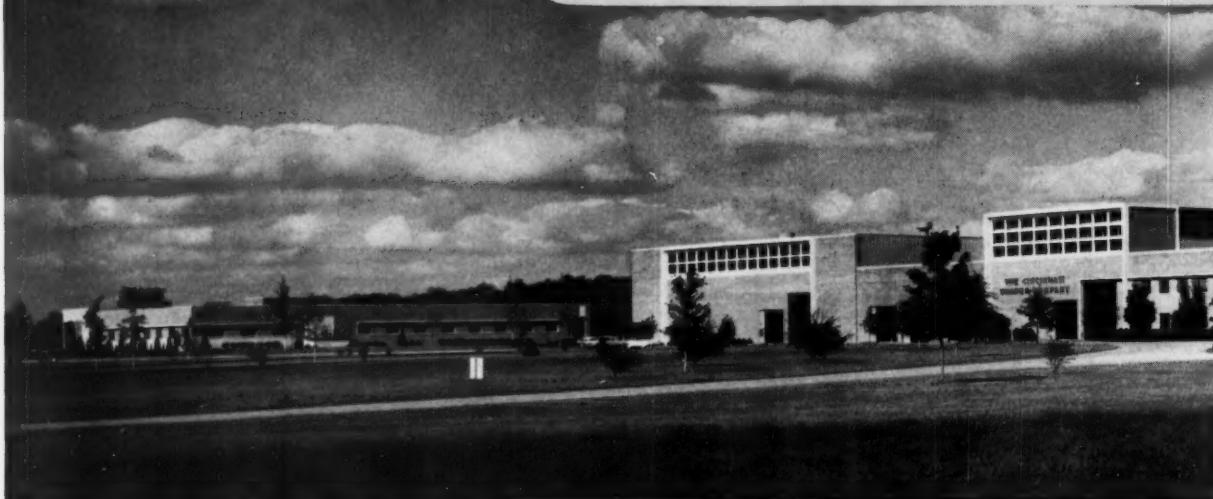
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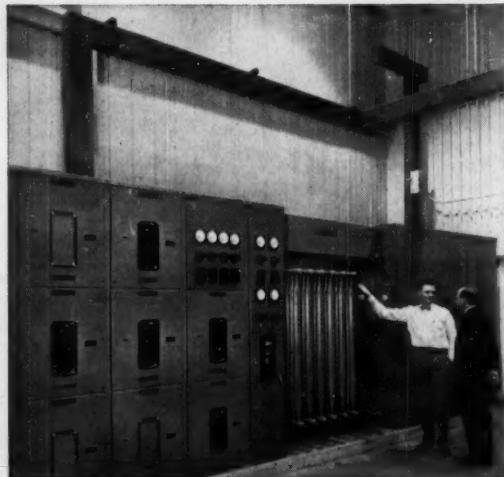
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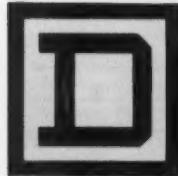
Square D, also, "points with pride" to the array of electrical distribution and control equipment which is on duty throughout this unusually efficient plant—and to the thousands of Cincinnati Shaper machine tools into which Square D controls have been built over a period of many years.

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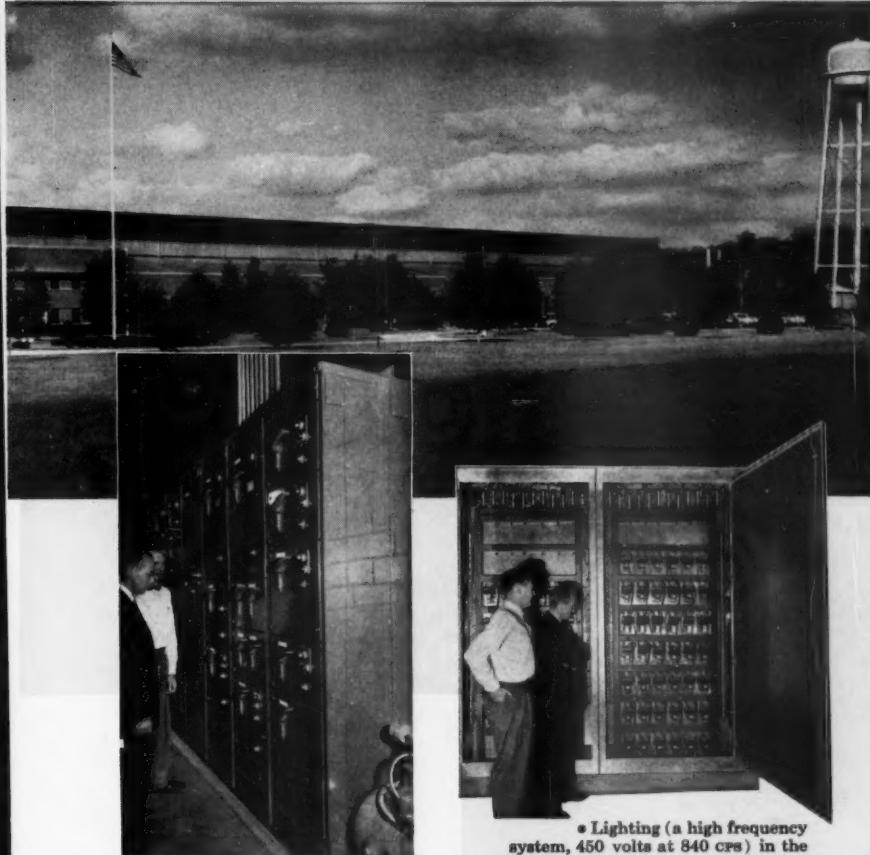
- Shown above is one-half of a Square D double-ended unit substation which feeds several runs of Square D plug-in duct. Notice the "T" in the duct installation which makes it easy to extend the bus run for future bus tie connection.



SQUARE D COMPANY



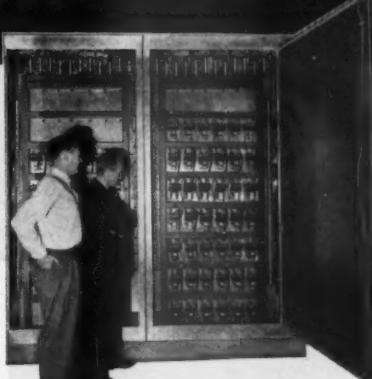
electricity is distributed and controlled



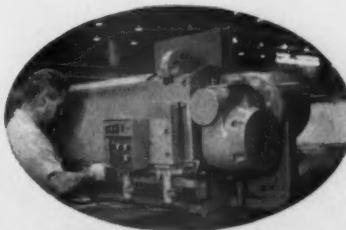
• This Square D control center in the Administration Building includes circuit breaker combination motor starters for the heat pump and air-handling equipment. Heat pump operation is automatically controlled through thermostats and programmed by clock system.



• Square D circuit breaker panelboards are installed throughout the plant. Breakers in upper half are for light switching; those in lower half for receptacles, emergency lights, drinking fountains, etc. Lockable, two-door arrangement prevents inadvertent switching of lower units.



• Lighting (a high frequency system, 450 volts at 840 cps) in the Administration Building is controlled from this panel. Note space for future additions of Square D contactors as they're needed.



• You'll find Square D controls on a lot of the machine tools which roll off Cincinnati Shaper's production lines. Above, Square D pushbuttons being installed on a power squaring shear.

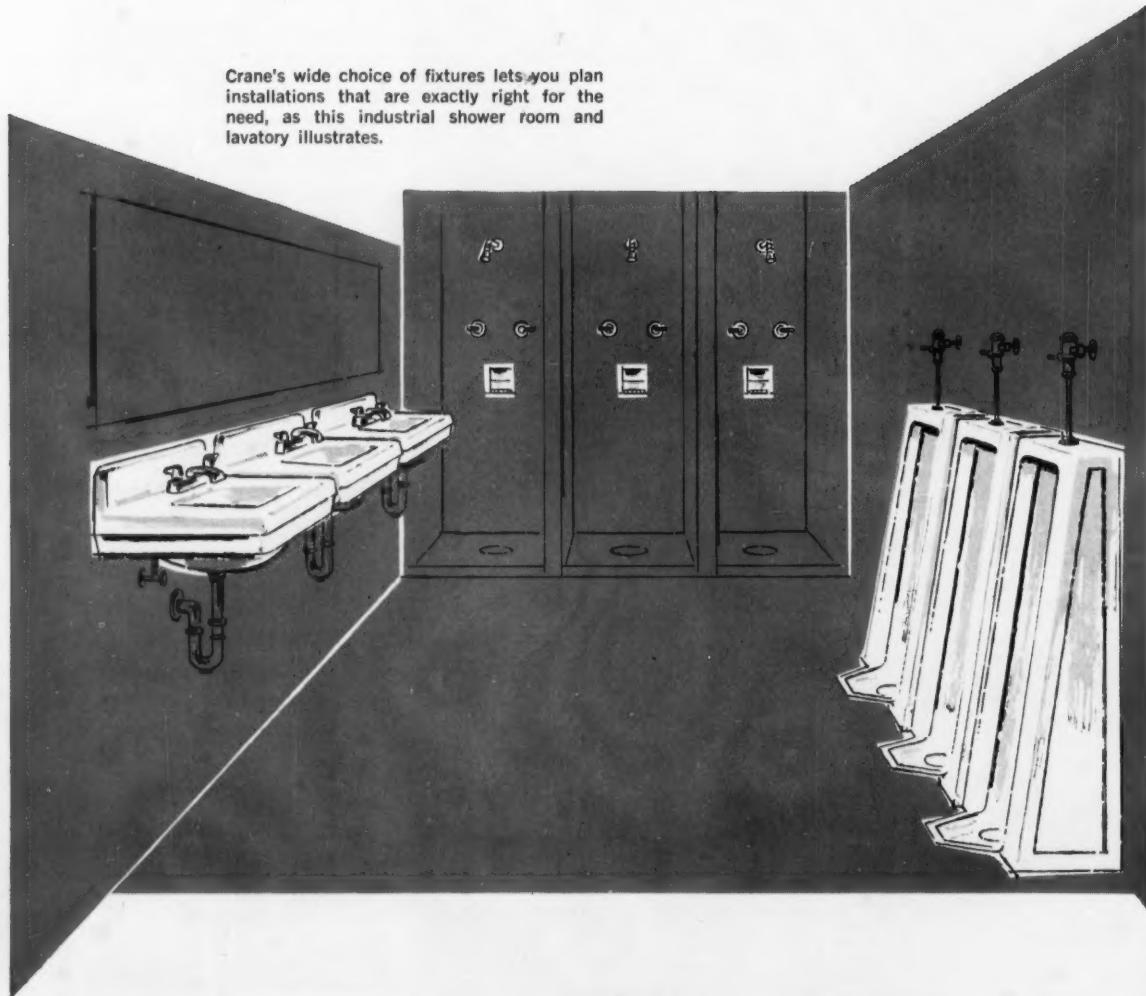
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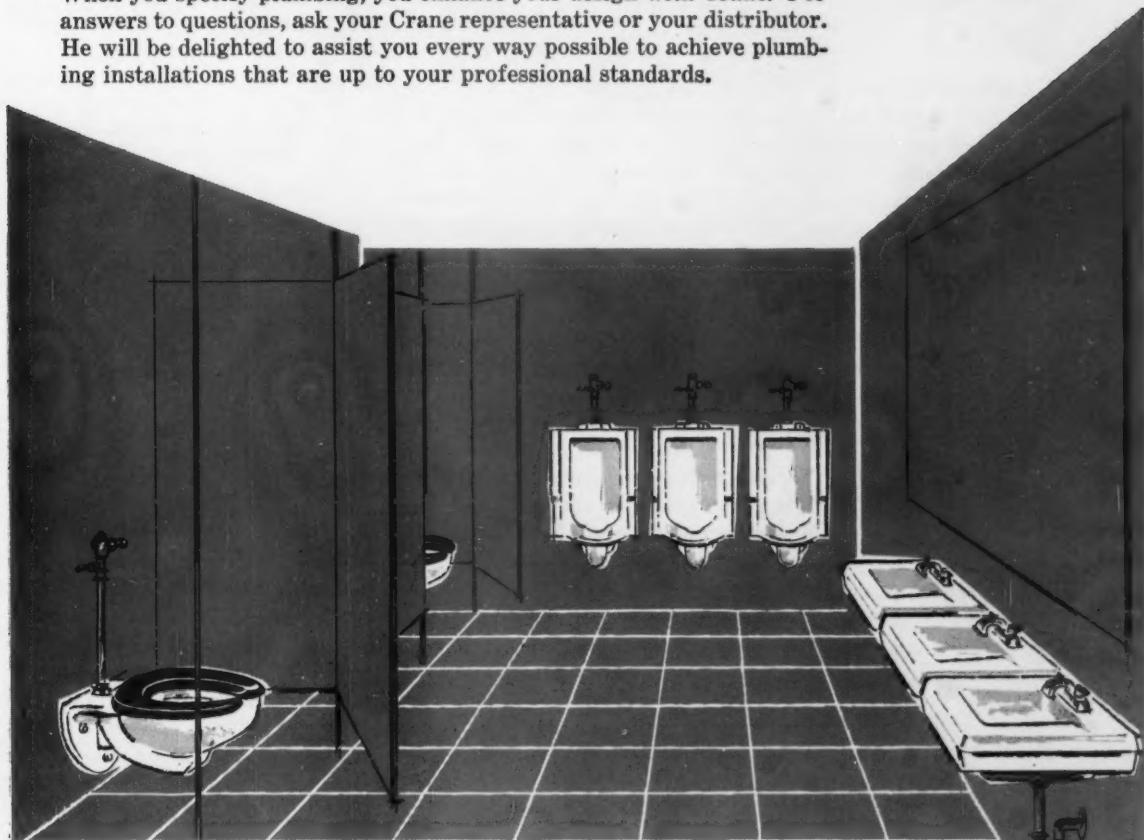
of quality

When you specify plumbing for commercial buildings, there are two sound reasons for choosing Crane.

1 Crane offers the functional beauty you want and Crane has the reputation for quality among the general public. Crane, therefore, is visible *proof of quality* in commercial buildings...and it costs no more.

2 Crane offers the most extensive line of plumbing for public and institutional use. There is a Crane fixture for almost every specialized use. It's engineered to last—even under hard use and maintenance. Cost of owning Crane is extremely low.

When you specify plumbing, you enhance your design with Crane. For answers to questions, ask your Crane representative or your distributor. He will be delighted to assist you every way possible to achieve plumbing installations that are up to your professional standards.



This layout shows a washroom where everything is off the floor for easy care and complete sanitation. Crane plumbing for commercial use is made to withstand heavy service, constant cleansing.



proof of quality—at no extra cost

Plumbing-Heating-Air Conditioning Group, P. O. Box 780, Johnstown, Pennsylvania
Valves • Electronic Controls • Piping • Plumbing • Heating • Air Conditioning



Free Engineering's Double Standard

(page 100)

Mason G. Lockwood is one of the best known and most respected engineers in this country. He is a past president of the American Society of Civil Engineers, and his firm is well known for its work in all fields of engineering — mechanical, electrical, and structural, as well as civil. This means that engineers in private practice have in Mason Lockwood an unusually outstanding but thoroughly representative example of a true, independent consulting engineer. So he not only can speak for consulting engineers, he can speak to them, as well. In his article, Lockwood calls the reader's attention to the rapid erosion of private practice engineering by government employee engineers. He calls for action. It is too late to stick a finger in the dike. Rather, everyone must line up and pass sandbags. The eroding current already is lapping the crest and spilling over. Lockwood says this is an opportunity as well as a threat, but consultants will have to work together.

Photographic Drafting

(page 116)

There is such an obviously close relationship between drawings and photographs that it is surprising no one had found a way, long ago, to make use of photography in engineering drawing. Now, Rust Engineering Company has a most excellent application for photography in design work, and Daniel F. Schauss shows and tells exactly how it works. Basically, it is for use with projects involving changes in piping or equipment layout or with plant extensions or modernizations. A photograph is made of the existing equipment, and then, after processing, the photograph becomes a part of a drawing showing the new layout and design. Prints can be made just as if the photodrawings were conventional drawings on tracing cloth or paper. This same technique is, we understand, being used in aerial survey work, and with a little thought it might well be extended into other design fields.

Oil created the recent demand for offshore structures although the Pharos of Alexandria and the Eddystone Lighthouse off the English Coast long ago proved the feasibility of this type of construction. Robert E. Hollick picks up the threads of recent trends in offshore structure design, classifies the various types of construction, points up the serious design problems, and makes some cautious predictions about the future. Hollick's article should be of interest to those interested in design details as well as readers simply seeking a general background. Although more offshore structures have been built for oil well drilling than for any other use, the Texas Tower radar stations in the Atlantic and sulphur mining platforms in the Gulf of Mexico also are interesting examples.

The Readers' Guide

When submitting his manuscript in response to our request for a discussion of free engineering, J. Donald Kroeker said, "It is not clear why I have been fingered for this topic, one of the most controversial subjects before our profession." But in his next sentence he makes it quite clear why he was chosen. He says, "I am increasingly disturbed by a type of free engineering hardly recognized as such. I am talking about the free engineering provided by manufacturers to consulting engineers, themselves." Strange, is it not, that many consulting engineers are opposed to all forms of free engineering but one — the exception is obvious. Kroeker takes the position that if it is a sin for the architect or contractor, it is doubly sinful for the consultant to take a fee for engineering work he does not do. Again, Don Kroeker has come up with a shocker. He is indignant, as he has every right to be, and he points his accusing finger right at the guilty person — the consulting engineer who is a party to a professional deceit, a paid participant in a conspiracy against the client.

Private Engineering On Public Works

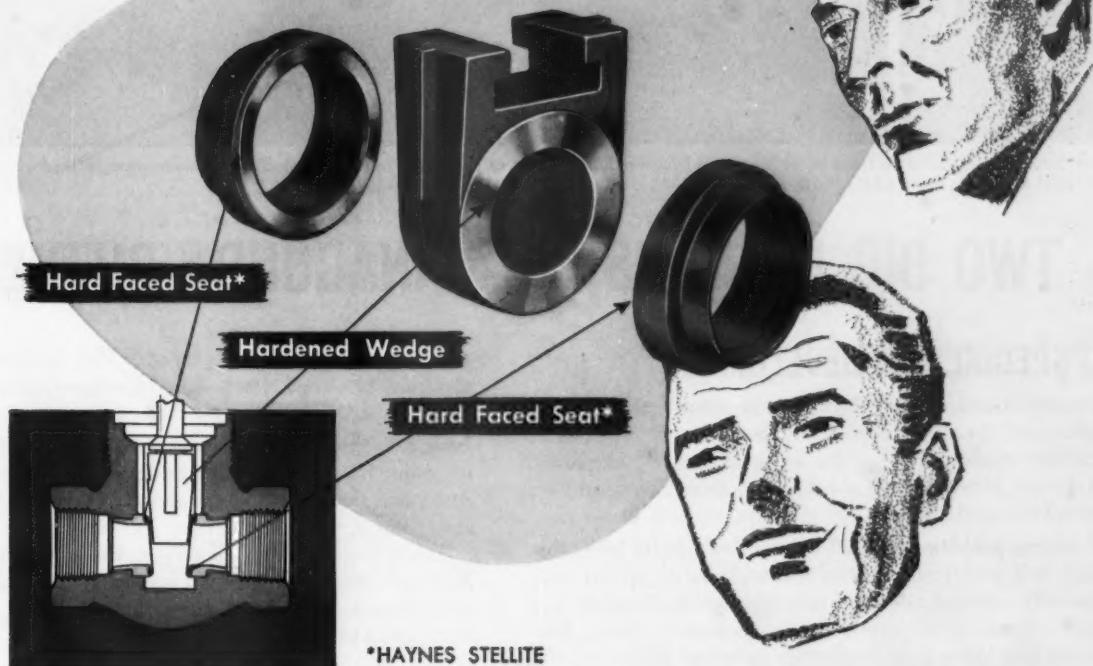
(page 88)

Designing

Offshore Structures

(page 106)

Tough valve buyers appreciate this kind of... **Toughness**



*HAYNES STELLITE

Here's why:—They know that to foil those troublesome valve "termites"—erosion, corrosion, and galling—requires built-in toughness which only seats faced with hard facing alloys AND hardened wedges can provide. Yes, it takes BOTH to do a real job and GP Valves provide both at no extra cost!

Vogt GP Valves feature the toughest and, since they are precision finished, the smoothest seating surfaces obtainable anywhere. That's why they are setting new standards of

performance—longer, drop-tight service with minimum, low cost maintenance—in petroleum refineries, chemical plants, power plants and other industries. Available in a complete range of sizes from $\frac{1}{4}$ " to 2" and rated 800 pounds at 850° F. and 2000 pounds at 100° F.



Catalog F-10 is available to you—please send request on your company letterhead. Address Dept. 24A-FCE.

HENRY VOGT MACHINE CO.
P.O. Box 1918—Louisville 1, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Cincinnati, Los Angeles.

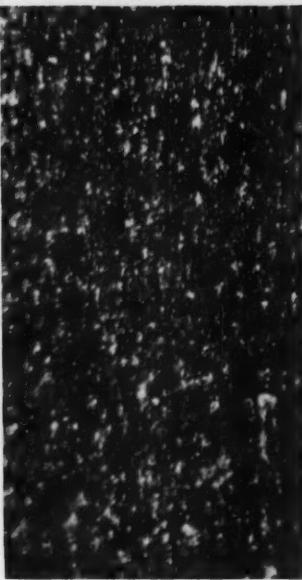
FORGED STEEL

VALVES

Vogt

* Union Carbide Corporation





Above you see magnified sections of ordinary cable insulation (left) and Anaconda Butyl (AB) Cable insulation (right).

These screens, used in the extrusion head to entrap possible contaminants, are so fine they actually hold water.

TWO BIG REASONS WHY ANACONDA BUTYL (AB)

1. SPECIALIZED DEVELOPMENT

Because Anaconda was the first to develop butyl-insulated cable—and because butyl handles differently from other rubbers—many problems came up during development. Here are some examples—and how Anaconda engineers solved them.

A mixing problem: Like all raw rubbers, butyl in its raw state is a practically useless material. So it's mixed with specially selected additives and ingredients. Because it is very difficult to disperse these ingredients in butyl, Anaconda had to develop an entirely new mixing process and separate facilities to avoid contamination. Look at the comparison photos and see how successful it is.

A shielding problem: To eliminate laborious and time-consuming cleaning of insulation surfaces, Anaconda de-

veloped a semiconducting tape* which firmly adheres to the insulation—and yet is easy to remove during splicing and terminating.

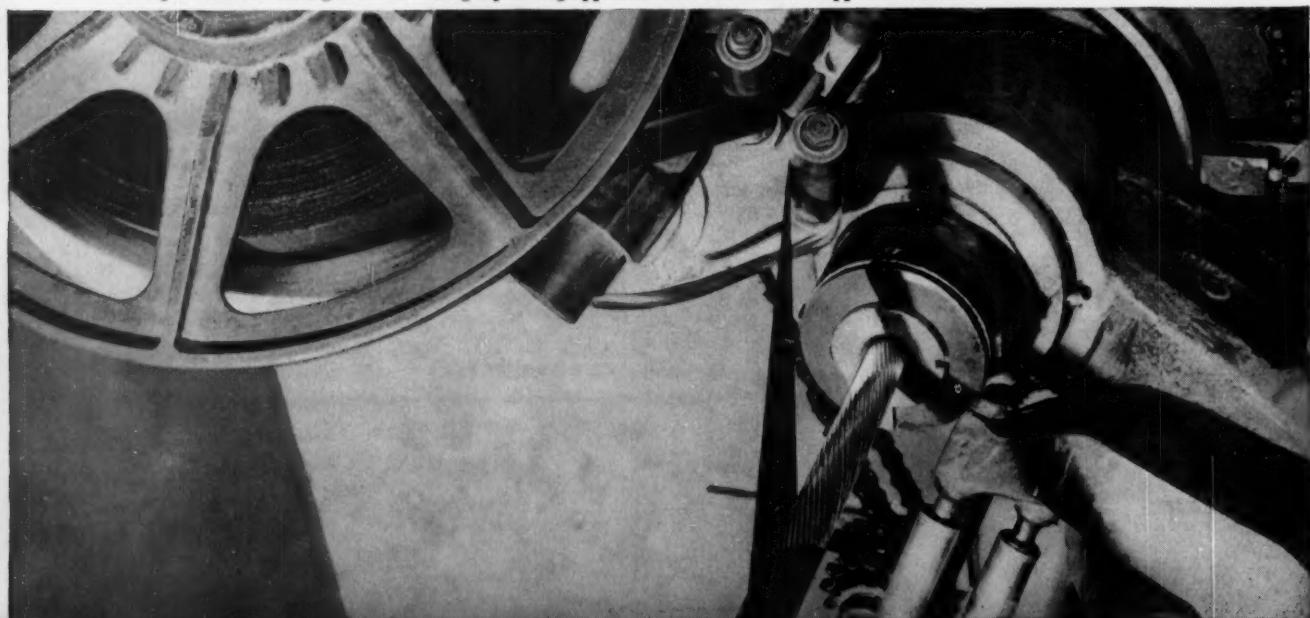
Even a vulcanizing problem: Ordinary vulcanizing equipment might have a tendency to deform butyl insulation. So Anaconda developed huge vulcanizing tanks which admit steam faster, vulcanize quicker and eliminate distortion.

These few examples show you the types of problems Anaconda engineers were up against. Their solutions help show you why you can be sure Anaconda Butyl (AB) Cable is the finest cable you can buy.

2. SPECIALIZED MANUFACTURE

Anaconda's new Marion Mill was designed to handle only one product—Anaconda Butyl (AB) Cable.

Close-up of semiconducting strand-shielding tape being applied to 500-Mcm tinned copper conductor.





An Anaconda development—semiconducting tape—adheres firmly to insulation, yet removes easily, facilitating splicing and terminating.

MEANS RELIABLE HIGH-VOLTAGE CABLE

The men behind this highly specialized equipment have but one job... to study and improve the design and manufacture of rubber-insulated high-voltage cable. Here are a few of the many places where they built precision right into the production line.

Insulation purity: For extra protection against contamination, the unvulcanized Anaconda Butyl is passed through a series of screens, one of which is so fine it will hold water.

Strand-shield taping: For better equalization of internal electrical stress, Anaconda applies a special fine-mesh semiconducting tape under the insulation of all stranded high-voltage cables.

Vulcanizing in lead: Conventional lead presses must stop periodically for refilling—severely heating up and often

damaging the cable section in the die block, so Anaconda extrudes lead continuously. In the next step, exceptionally large drums are used for vulcanizing in lead to eliminate distortion of jackets and insulation.

These few examples help show you that the manufacture of Anaconda Butyl (AB) is highly specialized, highly precise—and why Anaconda offers you the big advantage of consistent high quality.

*Pat. applied for 60037A

ASK THE MAN FROM

ANACONDA®

ABOUT BUTYL (AB) HIGH-VOLTAGE CABLE

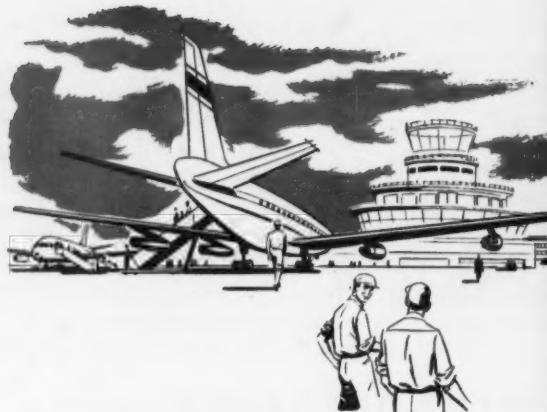


Huge reel entering large vulcanizing tank which vulcanizes cable quicker than conventional methods, eliminating distortion of insulation.



Acme

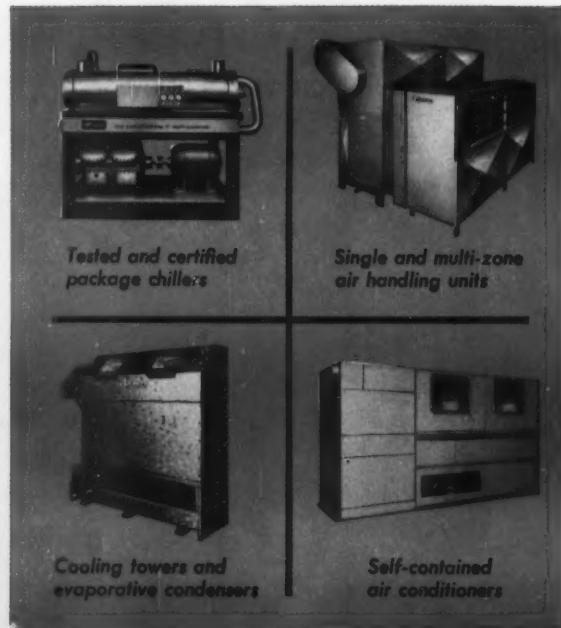
... the **practical** approach to



The First National City Bank of New York
... International Airport Branch



International Showcase of and comfort



Tested and certified
package chillers

Single and multi-zone
air handling units

Cooling towers and
evaporative condensers

Self-contained
air conditioners

Designed for the "Jet Age" by Skidmore, Owings & Merrill, this striking new First National City Bank Branch is located, appropriately, at New York's International Airport. And with its clean, modern architecture . . . its spaciousness, lighting and air conditioning . . . its handsome appointments and up-to-the-minute equipment . . . Citibank's International Airport Branch is truly an impressive showcase of banking efficiency, convenience and comfort.

MANUFACTURERS OF QUALITY AIR CONDITIONING
AND REFRIGERATION EQUIPMENT SINCE 1919

air conditioning



banking efficiency, convenience... conditioning (by *Acme*)

Headlining the comfort story . . . air conditioning by Acme. It's a story that rates headlines, too. Start with the fact that, per dollar invested, Acme-system equipment delivers the best return in cooling capacity and efficiency on the market today.

Then consider a few of the many other Acme advantages...*compactness and light weight*, saves valuable floor space, reduces building structural requirements (a case in point: installation at

International, where Acme's unit was one of few that would fit into space available) . . . *factory "packaging"* eliminates on-the-job assembly, cuts installation costs . . . *easily accessible controls* facilitates inspection-maintenance, keeps service time and expenses to a minimum.

Finally, a suggestion . . . get the whole story. Acme advantages are easy to prove . . . proof is readily available from your nearby Acme sales engineer.

Acme
INDUSTRIES, INC.
JACKSON, MICHIGAN

~~ELECTRIONIC~~ control.



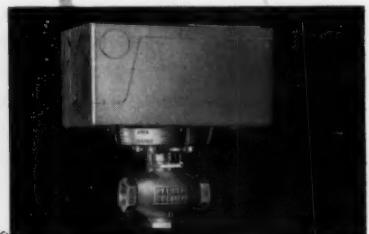
Use electricity,
the dependable
power source



... and
electronic
thermostats
with no
moving parts



AUTOMATIC CONTROLS ... RAY

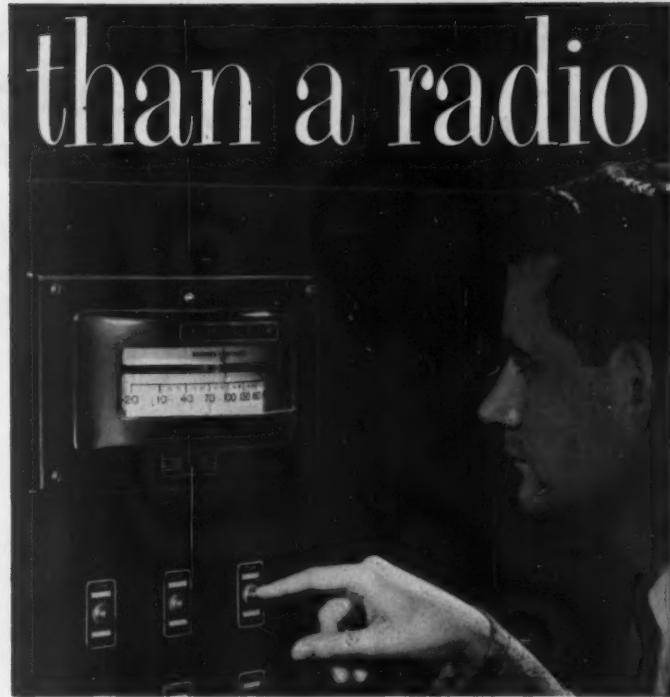


... simpler than a radio

More
reliable
than an
elevator



... to operate
transistorized
motor
operators for
accurate
control of
air and
liquid flow.



Everywhere you turn, reliable electric and electronic components and systems work for you. You hardly think about them — your radio, an elevator, your dictating machine, the generator cutoff in your automobile.

Barber-Colman *Electronic* control for heating, ventilating, and air conditioning provides even more dependable service than the items listed above. It combines electric and electronic components to give you fast, accurate sensing and adjustment of temperatures and air flow. You don't have to convert electrical energy into mechanical energy in an *Electronic* control system — it makes direct use of the electrical power that's available in every building.

Simpler than a radio, it's easy to service. More reliable than an elevator, it seldom needs attention. It is instantaneously responsive and extremely accurate. For large or small installations, *Electronic* control often costs less in the first place, and always costs less in the long run.

You don't have to be an electric or electronic engineer to understand *Electronic* control. You will feel right at home with it after you've read Barber-Colman's new *Electronic* Handbook which graphically explains the principles in a very readable way. You're welcome to a copy. Just call your local Barber-Colman automatic controls office or write:

BARBER-COLMAN COMPANY

Dept. E, 1360 Rock Street, Rockford, Illinois



Readers' Comment

that he, or she, is capable of serving a client, other than architecturally, with unbiased guidance, information, and development on manufacturing and construction projects."

Alfred Malkin, P. Eng.
Montreal, Quebec, Canada

Registration Laws

Sir:

As consulting engineers in the Province of Quebec, being active in the Corporation of Professional Engineers, we are interested in learning about consulting engineering practices in the States of the United States.

Would you be able to help us in our survey by telling us where we can obtain copies of statutes, laws, and/or regulations applying to the practice of engineering in U.S.A. Do we have to write to the various state bodies or has this information been collected in some form? In the former case, would you please be good enough to give us the names and addresses of persons to write to.

J. Hahn, P. Eng.

Surveyor, Nenniger & Chenevert
Montreal, Quebec, Canada

• *Synopsis of State Engineering Registration Laws* is published by NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS. ANOTHER GOOD PUBLICATION IS *Professional Engineering Registration Laws*, BY A. L. McCawley.

Conditions of Contract

Sir:

I have just had a very interesting note from a personal friend who is the senior partner in one of the very large engineering consulting firms in London. He says, "In Europe we have drawn up international conditions of contract

terms under the auspices of FIDIC. They are at present being received and revised by the various countries belonging to FIDIC. I think it is a great pity that the U.S.A. is not taking part as it would make these conditions of contract so much more valuable if they were also acceptable to American consulting engineers and contractors.

S. Logan Kerr
Consulting Engineer
Flourtown, Pennsylvania

• U.S.A. ACTUALLY IS INVOLVED SINCE CONSULTING ENGINEERS COUNCIL IS A MEMBER OF THE INTERNATIONAL FEDERATION OF CONSULTING ENGINEERS (FIDIC). UNFORTUNATELY, THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA ARE NOT YET MEMBERS OF FEDERATION INTERNATIONALE DU BATIMENT ET DES TRAVAUX PUBLICS (FIBTP).

SCACE Approves

Sir:

Your article "Setting the Right Fee for the Small Job," in the March 1960 issue, states the case for the beginning or specialty consulting engineer as well as any I have ever read. My congratulations and appreciation to Mr. Breese.

I would be interested in obtaining 50 reprints for dissemination by the South Carolina Association of Consulting Engineers.

John S. Myers
Electrical Engineer
Columbia, South Carolina

Opinion Worthy of Note

Sir:

I would appreciate it if you would mail copies of the article "Getting Along — Professionally," as written by John N. Richards, and which appeared in your January 1960 issue, to each member of the EJC

We Surely Can

Sir:

I note on page 235 of CONSULTING ENGINEER's April 1960 issue that Ghana has "what is undoubtedly the heaviest sea pipeline, with a total weight of 2000 tons."

I think that we can still "buy American." Los Angeles City retained Hyperion Engineers to design a sludge ocean outfall and an effluent ocean outfall, both of which are completed and in satisfactory operation.

1. Sludge ocean outfall: 20" internal diameter, seven miles long; \$2.5 million; 3700 tons.

2. Effluent ocean outfall: five miles of 12' internal diameter, 4800' of 8½' internal diameter, and 3200' of 6' internal diameter, \$20.2 million; 80,000 tons.

David L. Narver, Jr.
Project Manager
Hyperion Engineers
Los Angeles, California

Definition Suggested

Sir:

In perusing your January issue I was very interested in reading the article in connection with the definition of a consulting engineer.

In order to probably start a discussion rolling, I submit the following for what it may be worth:

"A Consulting Engineer is a person so specifically educated and trained in the arts and sciences

AT F.M. TAIT STATION, DAYTON POWER & LIGHT CO.

**BOILER CLEANING IMPROVEMENT
HELPS MODERNIZATION PROGRAM**

**SAVE \$40,000
Per Year in Operation
and Cut Blower Maintenance Costs**



Three of the Diamond Model IK Long Retracting Blowers installed to replace manually operated rotary blowers. Electric motor driven, they are controlled by the Automatic Sequential Panel. Air is used as the blowing medium. Rotary elements were retained in cooler locations and motorized for automatic operation and are also controlled by the Automatic Sequential Panel.

**DIAMOND BLOWERS and AUTOMATIC
SEQUENTIAL CONTROL PANEL**

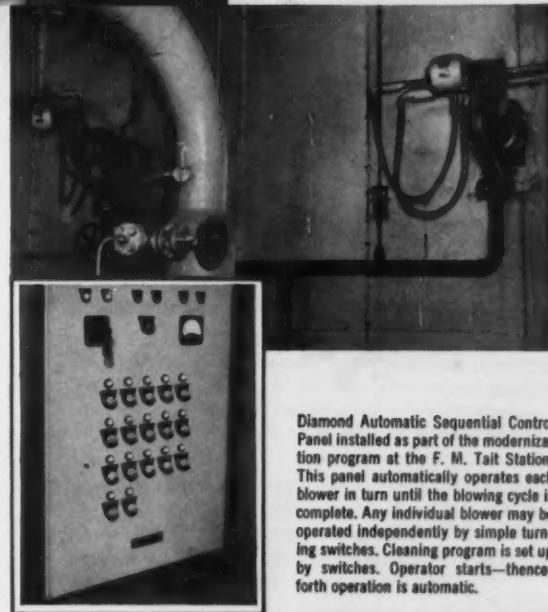
In the continuous struggle to cut operating costs, the Dayton Power & Light Co. has found a very useful tool in "Boiler Cleaning Modernization."

By applying the latest soot blowing equipment to four of their boilers at the F. M. Tait Station, together with other features of the modernization program, the Dayton Power & Light Co. was able to reduce the operating costs on these boilers by some \$40,000 per year and also cut blower maintenance costs.

On the first boiler that had its cleaning modernized, 17 rotating elements were removed; the remaining seven blowers of this type were electrified for automatic control. The cleaning equipment added consisted of five Long Retracting Blowers and six Short Retracting Blowers. All blowers are automatically controlled by a Diamond Selectromatic Panel.

This is one of many examples of the savings possible by improvements now available in Diamond Blowers and Automatic Sequential Control. Over the years Diamond has engaged in continuous aggressive research in boiler cleaning. This research has paid off in improvements that save you money and improve your operation.

Let us make a study of your boiler cleaning . . . perhaps similar savings can be suggested.



Diamond Automatic Sequential Control Panel installed as part of the modernization program at the F. M. Tait Station. This panel automatically operates each blower in turn until the blowing cycle is complete. Any individual blower may be operated independently by simple turning switches. Cleaning program is set up by switches. Operator starts—thenceforth operation is automatic.



**DIAMOND POWER
SPECIALTY CORP.**

LANCASTER, OHIO

8291

DIAMOND SPECIALTY LIMITED • WINDSOR, ONTARIO

(Engineers Joint Council) — AIA (American Institute of Architects) National Level Joint Committee, of which I am co-chairman.

W. W. Eshbach
Eshbach-Pullinger-Stevens-Bruder
Philadelphia, Pennsylvania

Confusion

Sir:

I am a member of the Consulting Engineers Association of California (affiliated with the Consulting Engineers Council). I receive CONSULTING ENGINEER and am very thankful, for it is in a class by it-

self and certainly the best of its kind in the country and probably in the world.

After reading the April 1960 issue I find myself quite confused as to your policy and the scope of your coverage. Specifically your brief on page 84 on NSPE!

I realize that your circulation is open to all consulting engineers and necessarily so, but this article dealing with ethics of consulting engineers in private practice in this magazine purports to sanction the functions of an association comprised almost wholly of engi-

neers who are working for governmental agencies and for industry. It appears from this particular article that you are reporting only the accomplishments of the employee organization as being thoroughly efficient, and I must say your exposé was most enlightening to me, but this seems to be the sphere in which the consulting engineer's associations should be functioning far more efficiently than NSPE. I belong to both groups; the cost of NSPE is \$25 a year while the cost of CEAC is at least several hundred a year and more!

Do you feel that NSPE should be a bargaining agent for the employees? There are about 60 members of NSPE in Los Angeles. There is a new program on to get about 400 new members from the City Department of Water and Power alone, all full-time employees, who will have an equal vote with each member like myself, who employs several or several dozen men. What chance will the employer have against such odds of employees when a vital issue comes up to a vote?

I wish you would print my letter and seriously consider the propriety of reporting on organizations in the engineering industry such as NSPE. Let me add that your article on page 24 about AAE was extremely good. Is NSPE in the same category? Page 61 points out the CEC objectives very well.

S. R. Wirth
Wirth Engineering Company
Culver City, California

- **CONSULTING ENGINEER FEELS THAT EVERY CONSULTING ENGINEER SHOULD BE A MEMBER OF —**
 - ¶ THE TECHNICAL SOCIETY OF HIS BRANCH OF ENGINEERING.
 - ¶ HIS STATE SOCIETY OF PROFESSIONAL ENGINEERS (HENCE NSPE).
 - ¶ HIS LOCAL ASSOCIATION OF CONSULTING ENGINEERS (HENCE CEC).
- THERE ARE OTHER ORGANIZATIONS HE SHOULD JOIN IF QUALIFIED, BUT THESE THREE ARE THE MINIMUM FOR A CONSULTING ENGINEER.

SILENCERS
ENGINEERED FOR:
WASTE HEAT
RECOVERY ...
STEAM, AIR
OR GAS
DISCHARGES ...
JET ENGINE
EXHAUST AND
INTAKE ...
INTERNAL
COMBUSTION
ENGINE
EXHAUST AND
INTAKE ...
AIR COMPRESSOR
INTAKES AND
DISCHARGES ...
BLOWER INTAKES
AND DISCHARGES.
SEND FOR
LITERATURE.

MAXIM
for Attenuation



Emhart Manufacturing Company
Maxim Division / Dept. 80
Box 216, Hartford 1, Connecticut

EMHART

engine power

BY CATERPILLAR

WHEN POWER FAILS YOUR CLIENTS EXPECT "BUSINESS AS USUAL"

The basic business of a building need not be suspended when utility power fails if it is equipped with a Caterpillar Electric Set for standby use.

Many of your clients' businesses include the saving of lives in operating rooms, broadcasting of essential information and keeping communication lines open in a crisis.

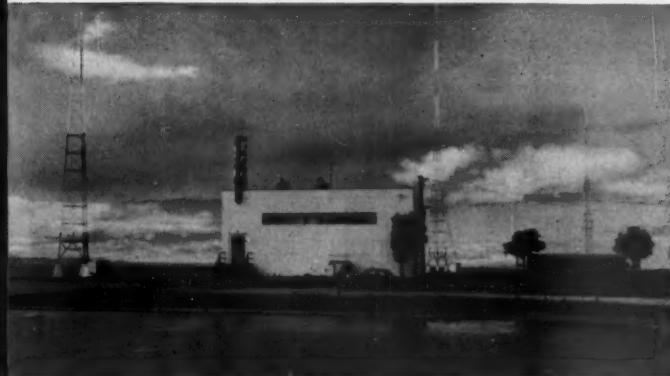
This is why it's no longer a question of "is standby power needed?" It's "what kind of standby power is needed?" And whenever you recommend and specify Caterpillar Electric Sets, you assure your clients of dependable emergency power, and insure them against loss

of production time, loss of selling time or even, in the case of hospitals, loss of life.

To get the answers on the most suitable type of emergency power for every building you design, see your Caterpillar Dealer or write to Engine Division, Caterpillar Tractor Co., Peoria, Illinois. The right Caterpillar Electric Set can be recommended to insure all types of buildings—and businesses—against electric power failure.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.



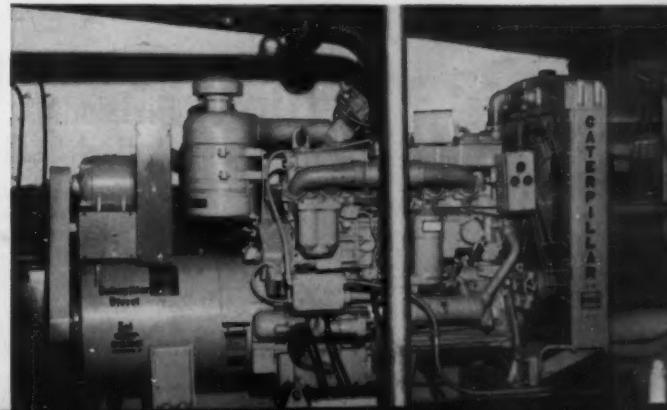
RADIO STATION KGO—This key station of the American Broadcasting System network at Newark, California, is located at east end of Dumbarton bridge across the bay from San Francisco. The station is powered 100 per cent by a Caterpillar Electric Set during emergencies, including the CAA lights on towers.

ST. JOSEPH'S HOSPITAL in Elgin, Illinois. A Caterpillar Electric Set furnishes emergency power for the entire hospital consisting of 153 beds, 5 operating rooms, elevators and the residence for the nurses. Hospital has had several power failures since emergency unit was installed.



TELEPHONE EXCHANGE—General Telephone Company of Florida (Sarasota) uses Cat Electric Sets for standby power. Exchange has 30,000 dial telephones. Long distance facilities are provided by a 48-position toll board. Out-of-town connections are made through 120 microwave circuits as well as underground cables.

This CATERPILLAR D326 ELECTRIC SET is equipped with automatic start-stop controls, so that when power fails, it assumes the load in 4 to 8 seconds. Caterpillar Diesels operate on widely available types of diesel fuel whose low combustion factor makes them a desirable safety factor, particularly in hospitals.



**It's new...
it's big...
it's strong...**

extra-heavy $\frac{1}{2}$ inch American

Welded Wire Fabric is now available with $\frac{1}{2}$ " diameter wires spaced as close as 2" on centers in both directions! These new areas of steel, plus the many time-tested advantages of Welded Wire Fabric, make it the ideal structural reinforcement for all types of construction—one-way slabs, two-way flat plates or flat slabs, walls, slabs on grade, etc.

Consider these advantages:

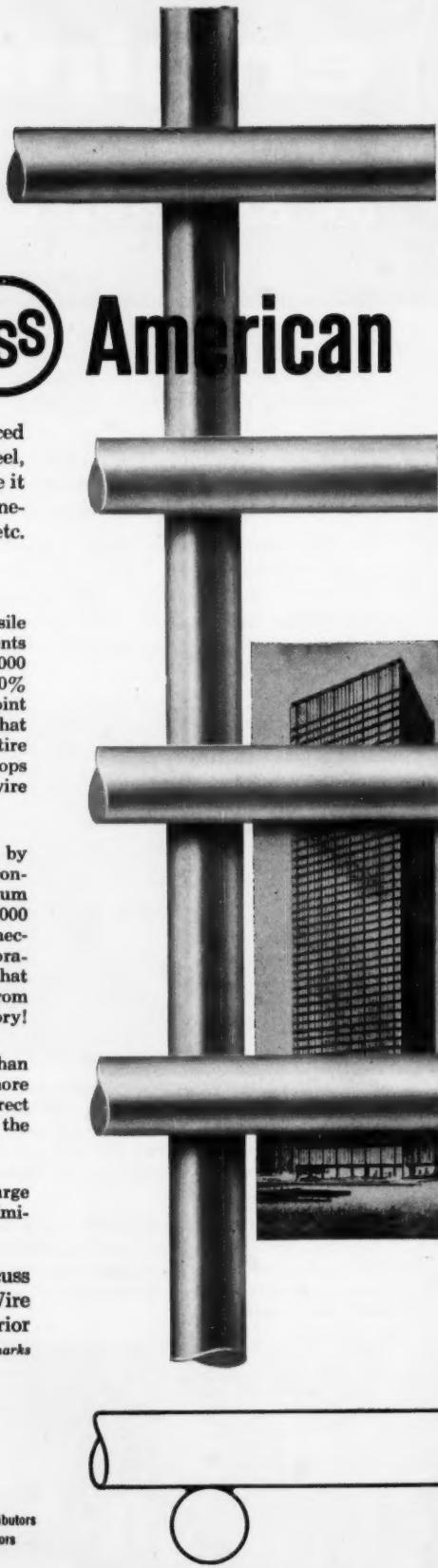
1. American Welded Wire Fabric is produced from cold-drawn high tensile steel wire. This wire is carefully produced to conform to the requirements of ASTM Specification A82-58T. The minimum tensile strength is 75,000 psi and the minimum yield point, as defined in this specification, is 80% of the tensile or 60,000 psi. Actually, cold-drawn steel wire has no yield point in the conventional sense—no sudden excessive elongation. This means that cold-drawn wire tends to resist stress practically throughout its entire strength range without revealing any sudden elongation such as develops in a typical hot-rolled bar. This physical advantage of cold-drawn wire makes it the ideal concrete reinforcement.
2. American Welded Wire Fabric is completely machine prefabricated by electrically welding all wire intersections. The strength of these welds conforms to ASTM Specification A185-58T which requires that the minimum average shear value of the weld in pounds shall not be less than 35,000 multiplied by the area of the longitudinal wire. This high-strength connection assures positive "mechanical anchorage" in the concrete. In fact, laboratory tests reported in the ACI Proceedings, Vol. 48, April, 1952, show that this anchorage is so good that fantastically high bond stress values from 1000 psi to 2700 psi are computed using conventional bond stress theory!
3. American Welded Wire Fabric is prefabricated with greater accuracy than can normally be relied upon in field work. The wires may not vary more than $\frac{1}{4}$ " center-to-center than the specified spacing. This assures correct placement and distribution of the steel. Also, the wires are drawn to the very close tolerance of 0.003".
4. American Welded Wire Fabric requires very little on-the-job tying. Large prefabricated sheets are shipped to the job and placed as a unit. This eliminates thousands of ties and results in important labor savings.

The representatives of American Steel & Wire will be pleased to discuss with you the many advantages and applications of Welded Wire Fabric. Just contact American Steel & Wire, Dept. O198, 614 Superior Ave., N.W., Cleveland 13, Ohio. USS and American are registered trademarks



**American Steel & Wire
Division of
United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad



Velded Wire Fabric

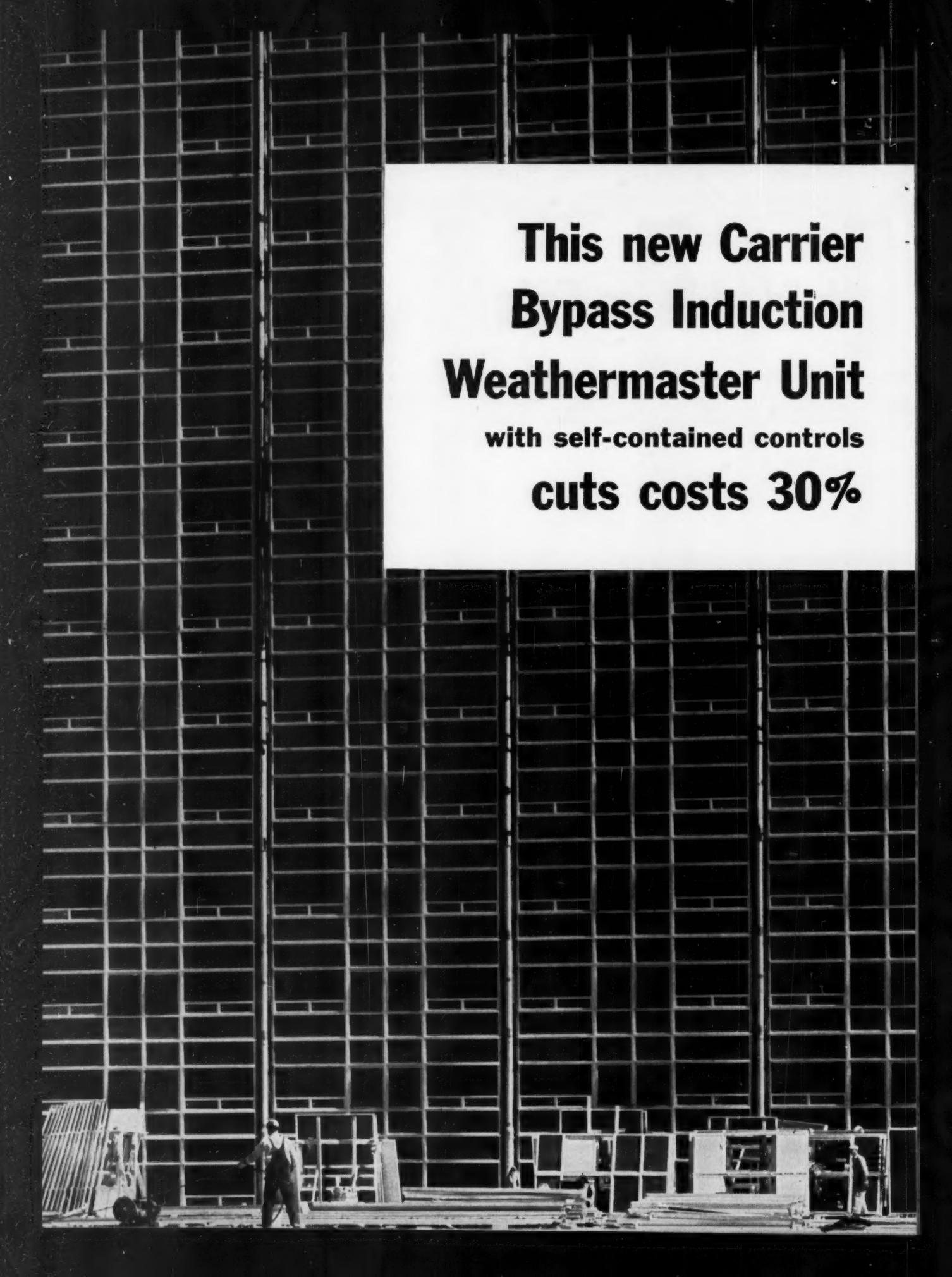


2"

1½"

--- 2" ---





**This new Carrier
Bypass Induction
Weathermaster Unit
with self-contained controls
cuts costs 30%**

UP TO NOW Induction-type room terminals for high-velocity air conditioning systems have been automatically controlled by a valve that regulated the flow of water through the coil. The valve and its thermostatic auxiliaries were costly. In addition, it was necessary to select and order the control assembly and the room unit separately. They were installed separately at the job site. All this meant extra design time, extra installation labor, extra installed cost.

NOW Carrier has developed a new 36R Weathermaster* Unit with self-contained automatic control that eliminates the water valve. The new terminal units are delivered to the job site complete, ready for installation. They require no pneumatic or electrical connections. They save design time and installation labor. And they cut installed cost of the unit and its control as much as 30%. For complete details write to Machinery and Systems Division, Carrier Corporation, Syracuse 1, New York. In Canada: Carrier Engineering Ltd., Toronto.

*Reg. U.S. Pat. Off.



The new Carrier 36R Weathermaster Unit with built-in automatic control makes use of the well-known bypass principle. Simple and reliable, it provides the same control versatility as other methods. The units are available with cabinets or for furred-in applications.

MORE PROOF OF
BETTER AIR CONDITIONING FOR EVERYBODY



EVERYWHERE



"Quote...End Quote"

Second Thoughts on Euratom

"...The Euratom Commission in Brussels is exercising great tact in negotiations with the U.S. government and the U.S. Atomic Energy Commission that must be causing almost as much embarrassment in Washington as they are in Brussels. In the middle of 1958, a U.S.-Euratom agreement was signed under which a chain of American-designed nuclear power stations was to be built in Euratom's six-member countries. Their construction was to be backed by an intensive research program on both sides of the Atlantic, the cost of which, estimated at \$100 million for each 5-year period covered by the agreement, would be borne equally by Euratom and the U.S.

"The power program has not materialized. In spite of a considerable element of subsidy from the U.S. government, public utilities have jibbed at the cost of nuclear plant. The only proposal going ahead now is in Southern Italy, and this is financed by the World Bank as its one and only venture into nuclear power. Two other projects which are eligible in the sense that they could be built within the time limits required (i.e., by 1963) are bogged down, in Germany over finance, and on the Franco-Belgian border over what the Commission calls 'administrative and institutional difficulties.' These difficulties may be overcome, but the ob-

vious reluctance of electricity undertakings even to put forward proposals for consideration under the joint program is a warning to Euratom, if any warning were needed, that nuclear power on the present American pattern will not be accepted in Western Europe. The horse refuses to drink." — *The Economist*, March 19, 1960.

Electrical Ordinance Revision

"Minnesota Association members in the St. Paul area are celebrating a recent revision in the St. Paul electrical ordinance calling for: 'All building plans and specifications (with the exception of family dwellings and small buildings) submitted to the Bureau for the purpose of securing a building permit shall be prepared and signed by a registered professional engineer, duly qualified in accord with the laws of . . . Minnesota.'

"This regulation establishes a significant precedent. Although always required by state law, there had previously been little evidence of enforcement. Getting its 'foot in the door' in St. Paul, the Minnesota Association of Consulting Engineers is now able to promote similar requirements in the electrical ordinances of Minneapolis and eight other Minnesota cities. It is hoped, following progress in the large urban areas, that a resolution can be presented to the League of Minnesota Municipalities for adop-

tion by all of the 840 cities and villages in the State.

"The job has, however, just begun. The next, and possibly even more difficult, step is to define who can sign what — which step may lead to the need for a revision in State Registrations Laws." — *CEC Newsletter*, March 1960.

Prestressed Concrete

"We have caught up and passed most other countries in the use of prestressed concrete for buildings. The only type of building in which prestressed concrete in the U.S. still lags behind other nations is the multistory building.

"In many European countries, buildings in excess of 12 stories have been prestressed, but in the United States we have used pre-stressing only in limited applications in high rise buildings." — A. H. Gustafsson, *Portland Cement Association*.

For Design Projects Too?

"Electronic computers, the substitute for the brains of many men, are now used extensively in design work. Calculators of all types are in constant use by contractors and designers. One engineering school, I happen to know, is seeking a grant of money to explore the possibility of using electronic computers in organizing and operating construction projects. What, if anything, will come out of this no one

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- This new Westinghouse Electric Operator is the same size and fits the same space as the breaker it controls. Its action is strong and positive, with the advantage of manual control when desired. In fact, this new electric operator does the same job for the smaller breakers that a motor operator does on the larger type breakers. What's more, the cost is much less. Electric operator works on 120, 240, 480 or 600 volts a-c; 125 volts d-c.
- There's a 4-page, 2-color illustrated brochure available describing more about the Westinghouse Electric Operator. For your copy write: Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

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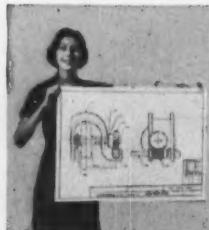
Bruning's new table-size Copyflex Model 320 gives you big machine capacity and performance at a price that puts many a big machine to shame! It's the perfect whiteprinter for firms and departments with *big* tracings—but with *small* reproduction budgets, cramped machine space, or both.

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knows, but their thinking was sparked by the fact that the Army uses computers on its logistic problems in war games. The question is, can similar methods be of value on large construction projects in solving problems of logistics, manpower, finance, and what have you? I am sure the skeptics among us may scoff at this possibility, but whoever dreamed a few decades ago of one man picking up and moving 100 cubic yards of earth by himself." — Lester C. Rogers, past president of AGCA.

Endorsement for ACIL

"The American Institute of Consulting Engineers is the fifth national professional organization to endorse the principle that laboratories should be selected by architects and engineers rather than contractors.

"Other professional societies which have formally endorsed the new policy are the ASCE, NSPE, AIA, and CEC. This policy has also been endorsed by the Concrete Industry Board of New York, Greater Atlanta Concrete Producers Association, and the Construction Industry Association of New Orleans.

"The function of laboratories performing inspection services is to determine whether specifications prepared by architects and engineers are fulfilled by the contractor. The method of laboratory selection by the contractor often resulted in determination on the basis of price alone. This procedure involved the laboratory in a conflict of interest in serving the owner, whose interests were paramount, and in serving the contractor who was selecting, employing, and paying for its services.

"The older practice placed the contractor in a situation where there was a conflict of interest between paying as little as possible for inspection services or upholding professional standards. These practices were fast destroying the ethical standards and reputations of all laboratories engaged in such



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work. The Southern Division of ACIL under the leadership of Barrow-Agee Laboratories, Inc., Memphis, Tennessee, and the Shilstone Laboratory, New Orleans, Louisiana, urged the improved professional treatment of this problem. The problem was presented to national organizations having a mutual interest in it. A plea was made for assistance in correcting this condition. Public acceptance to date has been widespread. Future plans are to continue to broaden the acceptance of this sound policy in all areas of public and private construction." — *ACIL Bulletin*, March 1960.

The Spending Trend

"You are familiar with the broad outlines of the spending syndrome of our times. It is apparent in municipal government, state government, and the Federal government. The chief concern of many . . . is to find new arteries of revenue to feed rising expenditures.

"Let me give you some examples of fiscal trends in the Federal government alone. In the last decade, fiscal year 1950 to fiscal year 1960: "—Total Federal taxes and receipts rose from \$36.5 billion to \$78.6 billion — an increase of 115%;

"—Expenditures for agricultural programs increased from \$2.8 billion to \$5.1 billion — a rise of 85%; "—Expenditures for natural resources rose from \$1.2 billion to \$1.8 billion — a growth of 50%;

"—Expenditures for welfare and labor went up from \$1.9 billion in 1950 to \$4.4 billion in 1960 — an increase of 130%;

"—Expenditures for major national security rose from \$13 billion in 1950 to \$45.6 billion in 1960, an increase of 250%;

"—Expenditures for interest on the public debt increased from \$5.7 billion in 1950 to \$9.3 billion in 1960 — an increase of about 60%.

"Now, here is a statistical point I want to make from these figures: project this same trend for the next decade and see what you get — a

Federal budget of \$170 billion in 1970! Impossible? Yet is that any more fantastic to imagine than the increases from \$3 billion in 1930 to \$9 billion in 1940, to \$40 billion in 1950, to almost \$80 billion in 1960?" — Maurice H. Stans, director of the *Bureau of the Budget*.

Financing Libyan Independence

"Since it became independent (on Christmas Eve, 1951), Libya has survived on foreign aid. When the newly elected parliament met recently at Tripoli there was much bold talk of dispensing with such help; but this cannot be done safely until that unspecified date when the oil revenues begin to come in. There are shadowy plans for 70 percent of the oil income to be put into a development fund, the provincial and federal governments getting 15 percent each for general purposes. The Libyans have before them examples of the sometimes unhappy experiences of the other oil-bearing Arab countries. They are not likely to repeat in detail the engineer's dream that once was Iraq, the plushy welfare state that is Kuwait, or the profligacy of Saudi Arabia." — *The Economist*, March 19, 1960.

Consulting Skills Benefit Everyone

"There has been a lot of loose talk about the use of consulting engineers in the Interstate Highway System. Some folks, apparently without knowledge of engineering realism, seem to feel that employment of consultants for such work is practically immoral.

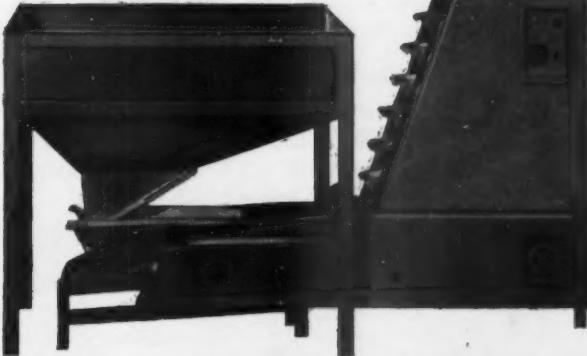
"We believe that a good engineering organization is an essential for every state, city, and county. We also believe that consulting engineers should be employed when a job requiring special knowledge or skill must be done or when a volume of engineering work is required beyond the work capacity of the existing city, county, or state staff. We do not think it is economical to maintain a public engineering organization large

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Probably the most efficient distance between any two points . . . You can see it at work for leaders in virtually any industry—moving powders, pellets, granules or solids—almost anything that freely flows—quickly, smoothly and undisturbed through vertical, inclined or horizontal planes for any distance. For instance:

interlocking stainless steel buckets of a number of sizes are filled by vibratory, belt or gravity feeds from top or underside of in-feed section at any number of stations . . . discharge at a multiple number of locations. Foods, drugs, chemicals . . . auto parts and cereals . . . confections and cake-mixes are handled without risk of separation of ingredients. Batching is simplified. Speed is matched to optimum speed of processing or packaging machines; it stores products in its own buckets, or conveys to assembly points for temporary storage.

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enough to meet all potential needs; nor do we think such organizations should hire specialists for a specific job and then either discharge them after the job is completed, or utilize a small part of their skills in routine work.

"The fees consulting engineers get are not large; as a result they normally do the work at a no higher cost. Their use allows the work to be speeded up. They supplement and strengthen existing civil service staffs. Each group of engineers has its place in which it performs best and most economically, and a judicious use of each results in the greatest good to the taxpayer." — *Public Works*, April 1960.

Architects Join the Battle

" . . . Architects have joined — though on a side issue — the battle in Washington over the use of consultants on government construction. What brought in the American Institute of Architects was a ruling by the Bureau of Indian Affairs that has cut off all outside architectural contracts for nearly a year. Said George Wright (of Stanley & Wright, Albuquerque, N. M.), 'The claim . . . that it is cheaper to use government architects . . . preparing standardized plans . . . is false, and the reasoning erroneous. To be sure, the lure of standardized or stock plans . . . is intriguing. But the fact is they don't work.' " — *Civil Engineering*, March 1960.

Pay Day Professionalism

"Refusal by the Supreme Court to review a lower court decision has, in effect, upheld the earlier verdict that procedure for payment, not type of work, is the criteria for determining whether or not a man is a 'professional.' Thus an award of as much as \$3000 overtime pay, per man, to 10 employees of the Far West Engineering Co. (a Los Angeles consulting firm), stands.

"The fact that the men were paid on an hourly, rather than salary, basis outweighed Far West's con-

tention that, as graduate engineers employed in 'creative and design' activity, all were 'professionals.' Under certain conditions even officers of firms, if paid on an hourly wage scale, could be held subject to this decision and eligible for overtime pay under the Wage-Hour Law." — *CEC Newsletter*, March 1960.

Lighting Load Problems

" . . . For one thing, short-circuit currents in commercial buildings are now of such magnitude that they must be considered in the design of the service and selection of protective devices. Today, utility company systems have expanded, and are expanding even more, to serve increased air conditioning and increased lighting loads. The increased plant capacity (generators, substations, and distribution systems) will deliver larger and much more damaging short-circuit currents at the users equipment.

"Another problem arises from the fact that higher loads have increased the amount of heat given off by equipment confined in the limited areas available in commercial buildings. To help counteract this, conditioned air exhausted from other spaces may be led through the switchgear room and closets. This exhaust air may be considerably warmer than the human comfort level, but it will still be cooler than outside air during the summer months and will maintain acceptable equipment room temperatures.

"Providing for additional electric loads and shifting loads after a building is completed, due to tenant requirements, poses another problem. These loads arise from such items as data processing machines, other office equipment, and the addition of higher light levels. The question arises as to how far provision for such additional loads can be made in a base building. — *Technical Letter*, Syska & Hennessy, April 1960. □



NOTICE!

60 Second Contact Convertibility

ALLEN-BRADLEY CONTROL RELAYS

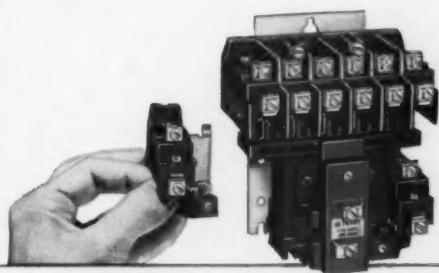
can thus easily be changed
from N.O. to N.C. (or vice versa)

Why not give yourself a real surprise! We refer to the ease with which you can convert the contacts of these Allen-Bradley Bulletin 700 Type BR control relays. Using only a screwdriver, contacts can be changed from normally open to normally closed (or vice versa) in seconds—without removing the relay from its mounting—or its wiring. This "on-the-spot" convertibility certainly suggests an appreciable moneysaving reduction in your relay inventories.

Extensive tests have proven conclusively that the Bulletin 700 Type BR relays are good for many—and we mean *many*—millions of trouble free operations. A "built-in" permanent air gap completely eliminates all possibility of magnetic sticking. Naturally, the double break, silver contacts never need attention. Also, the molded coil is your assurance that even the most severe atmospheric conditions cannot cause trouble. Please write for full details on these relays today!

BUT HEAR THIS!

In the event that when "on-the-job" it is discovered that something was either overlooked or added, the standard Bulletin 700 Type BR—either 2, 4, or 6 pole relay—can easily have added to its base, out in the field, either one or two switching poles. It is done as easily as "falling off a log."



General-Purpose
NEMA 1



Explosion-proof
NEMA 7



Waterproof
NEMA 4



FIVE RELAYS
IN ONE



This shows how a
Type BR relay
can be arranged
—in seconds—to
do the job of five
different relays.

3 N.C.—1 N.O.



4 N.C.

3 N.O.—1 N.C.



2 N.O.—2 N.C.

4 N.O.

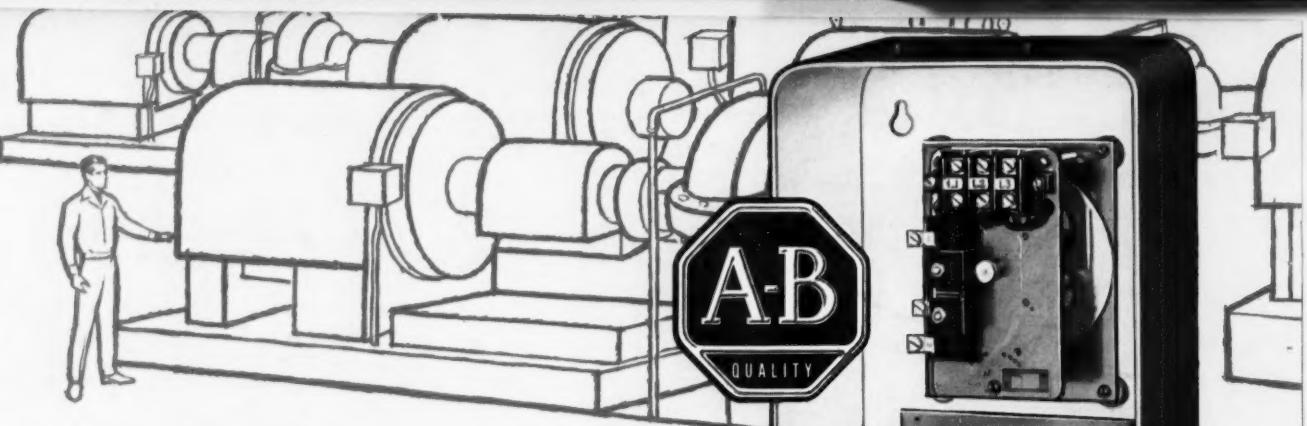


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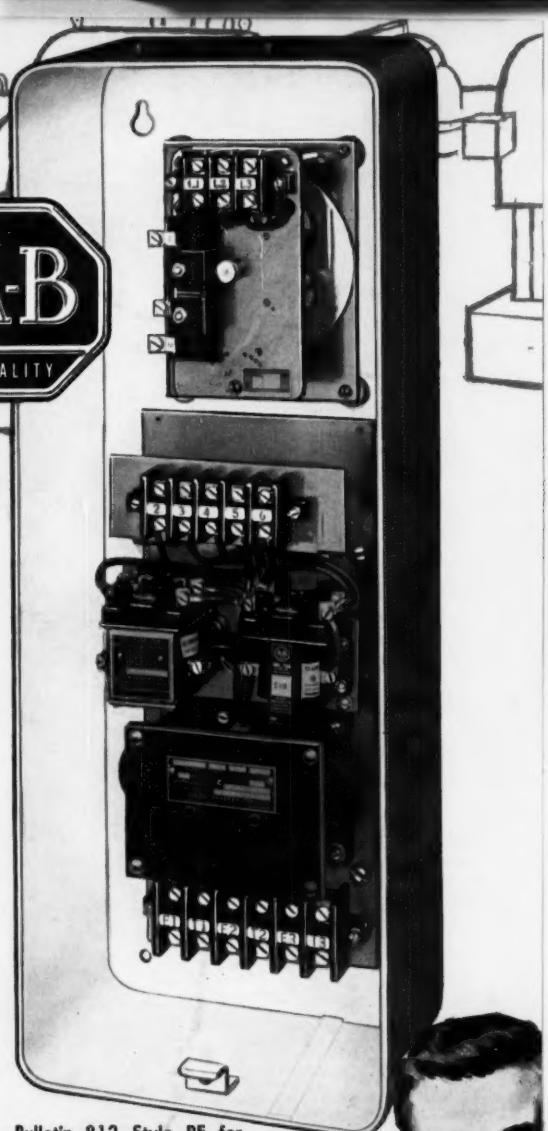
It's sound "economy" to guard your investment in expensive motors and equipment against the extensive damage that can result from a phase failure or phase reversal. Allen-Bradley's Bulletin 812 Style RF relay provides complete, positive protection against both of these hazards.

The Bulletin 812 Style F phase failure relay instantly detects all open phase conditions on a motor branch circuit and removes the motor from the line—yet is not subject to nuisance dropouts from transient line fluctuations. An unusual feature of this Style F relay is its positive response, regardless of motor load or type of motor branch circuit employed.

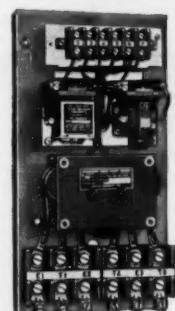
The Bulletin 812 Style R phase reversal relay disconnects the motor from the line—whether it is running or not—when a phase reversal occurs on the line side of the relay. Thus, it can be used to protect a single motor or a group of motors. Furthermore, the Style R relay removes the motor from the line should a phase failure occur while the motor is stopped.

All A-B Bulletin 812 relays are completely "fail safe." It will pay you to investigate this economical insurance against the heavy losses that can—and frequently do—result from phase failure and phase reversal. Write today!

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Bulletin 812 Style RF for Phase Failure and Phase Reversal consists of Style F Phase Failure and Style R Phase Reversal relays in the same enclosure.



Bulletin 812 Style F for Phase Failure



Bulletin 812 Style R for Phase Reversal

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Motor
Control

8-60-RH

Ljungstrom rotor half is hoisted into place at Public Service Co. of Indiana's 600,000 KW generating station at New Albany, Indiana. When complete, baskets filling the chambers inside the rotors will provide approximately 1,500,000 sq ft of heat-exchange surface. This is one of the eight Ljungstroms being installed to serve four boilers, each evaporating 1,000,000 lbs of steam per hr. The New Albany station is scheduled for completion in 1961.



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Lifetime Air Preheater Service means that Ljungstrom engineers make regular calls *throughout the life of each unit*. They check to make sure your Ljungstroms are working at top efficiency, and that they'll continue to work that way. This service policy covers all Ljungstroms—right from the very first installation made in 1923.

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Globe Sprinkler Systems are a product of The Fyr-Fyter Company, which also offers SAFA alarm systems, fire hose and extinguisher cabinets, and a complete line of lightweight, easily-operated fire extinguishers. Be positive your present school buildings are completely fire-protected by consulting an experienced Fyr-Fyter representative! He also offers analysis and recommendations, at no obligation, if you are planning a new school or additional facilities.

Don't let a disaster like the recent Chicago school fire strike your community! Write today to The Fyr-Fyter Company, Dayton 1, Ohio.



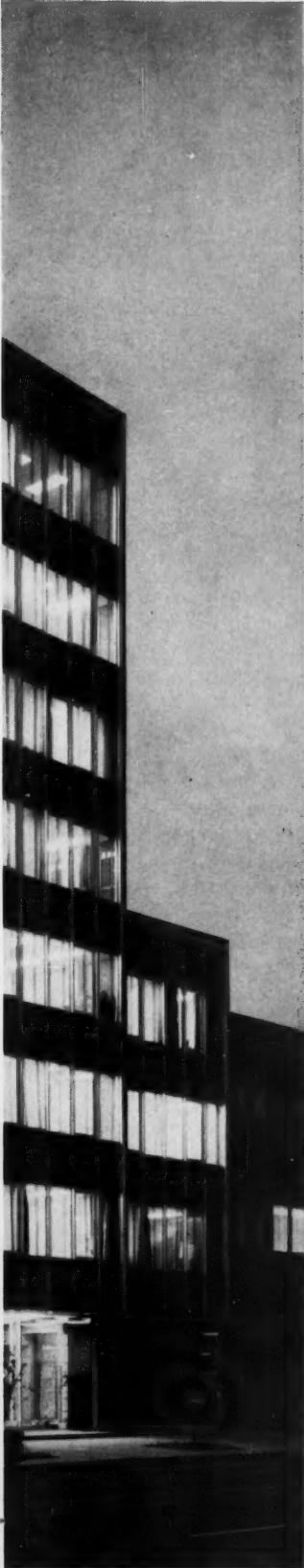
Main building of Goodall School and separate two-story facility are both protected with Globe Sprinklers. Globe sidewall sprinklers were utilized in classrooms and corridors—completely effective, yet architecturally unobtrusive!



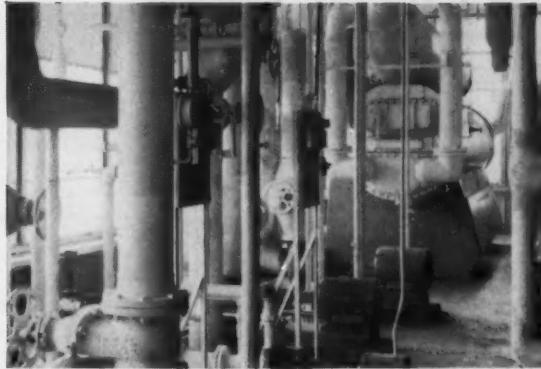
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This new 3101 Euclid Avenue Building in Cleveland meets every modern requirement in the book. Attractive exterior, with glass and aluminum curtain walls. Most comfortable interior, with air conditioning by Gas-operated Carrier Absorption Refrigeration.



Attracts tenants with comfort cooling by GAS-operated CARRIER Absorption Refrigeration



AIR CONDITIONING PENTHOUSE. This equipment in penthouse atop the building includes two gas-fired Bryant boilers, 300-ton capacity Carrier Absorption unit to chill water for the Carrier Weathermaster air conditioning system, and Carrier cooling towers, too. Roof-top installation frees basement area for other uses.

H. L. Vokes Company of Cleveland, designers and builders of the new 3101 Euclid Avenue Building in that city, are experts in two-way satisfaction. They satisfied their tenants and their own cost requirements with one of the most efficient types of modern air conditioning—Gas-operated Carrier Absorption Refrigeration.

Comfort cooling in this building starts at the same two gas-fired boilers that furnish heat in winter. The Carrier absorption unit uses low pressure steam from the boilers as the energy source for water chilling. Thus, no prime mover is needed. Boiler capacity is put to use on a year 'round basis. And thrifty gas keeps fuel costs low.

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The Legal Aspect

MELVIN NORD, P.E.

Consultant in Legal and Technical Problems
Patent Attorney

A Comparison of Two Recent Conditions of Contract

PRINTED "Conditions of Contract," which become a part of the client-engineer agreement, are coming into more general use. Consulting engineers would do well to know just what these "conditions" say. Therefore, we begin here a comparison of two relatively recent standardized "Conditions of Contract" forms — the "General Conditions of Contract," issued by the Consulting Engineers Council (1958), and the "Conditions of Contract (International) for Works of Civil Engineering Construction," issued by the Federation Internationale des Ingénieurs Conseils (FIDIC) jointly with the Federation Internationale du Batiment et des Travaux Publics (1957).

sions of the contract in the following two respects:

"(a) Failure of the engineer's representative to disapprove any work or materials shall not prejudice the power of the engineer thereafter to disapprove such work or materials and to order the pulling down, removal, or breaking up thereof.

"(b) If the contractor shall be dissatisfied by reason of any decision of the engineer's representative he shall be entitled to refer the matter to the engineer who shall thereupon confirm, reverse, or vary such decision."

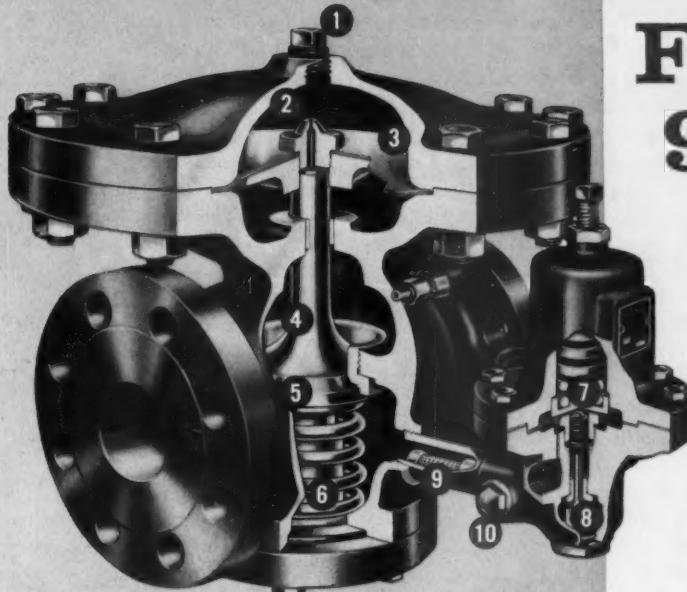
The first of these exceptions could prove a great surprise and booby trap to persons unfamiliar with the International form. Obviously it could be extremely serious for a contractor. It also could be very serious to an engineer who fails to realize that he has this right to follow up and correct his representative and thus fails to exercise this right on an occasion which demands it.

Responsibility and Authority

In general, the responsibility and authority of the engineer is similar under both forms, i.e., supervision of the work (CEC Sec. 2.3.01; Int. Sec. 2), including testing and examining materials and

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workmanship (CEC Sec. 2.3.05; Int. Sec. 2), and access to all parts of the work (CEC Sec. 2.3.05; Int. Sec. 37). However, there is a substantial difference in connection with access. The International form (Sec. 37) provides that the engineer has "access to the works and to the site and to all workshops and places where work is being prepared or whence materials, manufactured articles, or machinery are being obtained for the works," and requires the contractor to "afford every facility for and every assistance in or in obtaining the right to such access." This is much stronger than the corresponding provision in the CEC form (Sec. 2.3.05), which merely provides "access to all parts of the work." It is true that the CEC form also says, in the same section, that the engineer's "inspection may include mill, plant, or shop inspection" but these terms are not defined nor is there any specific provision for *access* in these instances. It also should be noted that the term "may" in this connection seems weak, in that it does not expressly give any unqualified right to inspect although that it is presumably what is intended.

Uncovering of Work

Both forms include provision for uncovering the work to permit inspection by the engineer, but the International form is again substantially stronger. The International form (Sec. 38) first provides that "no work shall be covered up or put out of view without the approval of the engineer or his representative," and requires the contractor to "give due notice to the engineer's representative" before covering up. The CEC form contains no such provision.

Both forms (CEC 2.3.06; Int. 38-2) provide for uncovering of covered work at the request of the engineer, but there are some important differences here, too. The CEC form makes this uncovering extra work where the work turns

out to be acceptable; the International form makes it extra work if the work is acceptable, *provided* there also has been compliance with the requirement of "due notice" before covering up. Furthermore, the International form applies to *all* work; whereas, the CEC form applies expressly only to *completed* work.

Suspension of Work

Under the CEC form (Sec. 2.3.03), the engineer has the authority to suspend the work, wholly or in part, under any of the following conditions:

- ¶ Unsuitable weather;
- ¶ Other conditions considered by the engineer unfavorable for prosecution of the work; or
- ¶ Failure on the part of the contractor to perform properly under the contract.

The International form (Sec. 40) permits the engineer to suspend the work whenever he considers it necessary. However, the employer (or as we would call him, the owner) must pay the extra cost unless the suspension is:

- ¶ Otherwise provided for in the contract;
- ¶ Necessary for the proper execution of the work because of weather conditions affecting the safety or quality of the works or by default on the part of the contractor; or
- ¶ Necessary for safety of the works.

Thus, the engineer has greater discretion to suspend the work under the International form than under the CEC form. However, as to these additional situations, the owner must pay for the costs incurred.

Engineer's Decisions

Generally speaking, the engineer's decisions are final in disputes under both forms. However, there are, again, some important differences. Under the CEC form (Sec. 2.3.02), the engineer's decisions are not final but are subject to arbitration upon demand by the owner

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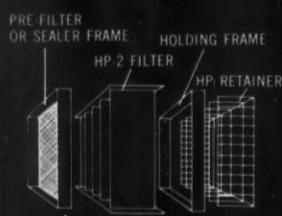
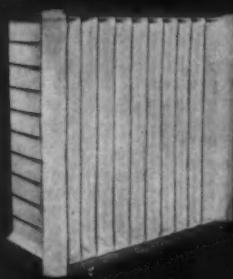
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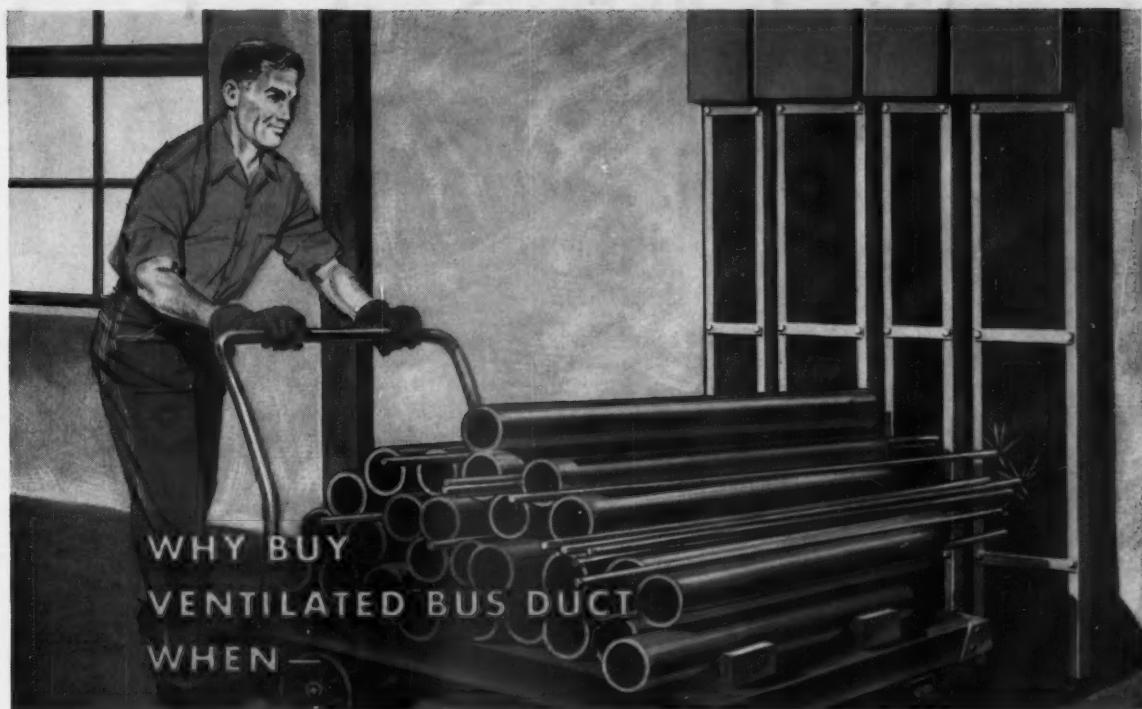
or by the contractor "where time and/or financial considerations are involved." The contractor cannot, however, delay the work because arbitration proceedings are pending (CEC Sec. 2.3.04).

The International form, on the other hand, expressly provides that except insofar as it is legally impossible "the contractor shall execute, complete, and maintain the works in strict accordance with the contract *to the satisfaction of the engineer*" (Int. Sec. 17). This unquestionably places very great power with the engineer beyond that provided under the CEC form. While such a "satisfaction" clause will not allow the engineer to be absolutely arbitrary in rejecting work, it permits him to apply his own subjective standard instead of an objective standard. In addition, Int. Sec. 67 also provides that the engineer's decisions are final. However, the catch is that *all* decisions of the engineer are subject to arbitration (Int. Sec. 67). His decision remains final until completion of the work, however.

Under the CEC form, request for arbitration must be made within 10 days of receipt of the engineer's decision (CEC Sec. 2.3.04). The International form, on the other hand, allows 90 days (Int. Sec. 67).

Understanding Desirable

This gives an idea of some of the ways that these two general conditions differ. Since one is designed for domestic and one for international work, these differences are not necessarily conflicts. However, the Consulting Engineers Council is a member of FIDIC, the International organization and is expected to assist in revising the International Conditions of Contract when such revision is undertaken. It would be wise to bring these differences into accord where possible or make sure the differences are fully understood by engineers engaged in both domestic and international work. ▲▲



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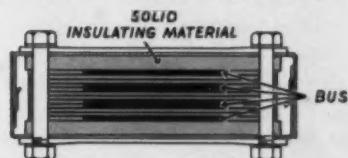
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Heard Around Headquarters

MARJORIE ODEN,
Eastern Editor

ONE OF OUR acquaintances, a "grass-roots" engineer from Peoria, was in town the other day to attend a meeting of a Founder Society subcommittee. After a morning spent with his group, he said he sort of hated to see them move out of the old Engineering Societies Building. His reaction to life on 39th Street was that even now that small, solid core of members who make a semicareer of committee work tend to feel that their activities are equal in importance to those of the State Department or the Pentagon. He is afraid that when the move is made to Turtle Bay, the several boards of directors may confuse themselves with the Security Council. He insists that at the close of his subcommittee meeting they made him prick his finger and, with his own blood, sign a pledge to secrecy. He heard rumors that major standing committees and the top councils were forced to participate in simply horrible, laborious secrecy rites, and at the end of each meeting the assembled officers had to stand and be led by the president in a rousing chorus of "Keep Well the Secret, Charlie, The Members Must Not Know."

Viva la Chemical Engineers

The American Institute of Chemical Engineers is chalking up two firsts at a meeting this spring. On June 19 through 22, the Chemicals are holding a joint meeting with

the *Instituto Mexicano de Ingenieros Químicos*, in Mexico City. This is the first joint meeting of the two groups, and the first time the 52-year-old Chemicals have met outside the U. S. or Canada.

Life Members

The New York Association of Consulting Engineers, at a recent meeting, revised the provisions for life membership eligibility. According to the new bylaws, a partner or officer retiring from a member firm now can be named a life member even if his firm continues in business after his retirement. The previous bylaws allowed life membership only to principals of small firms which had been disbanded after the man's retirement.

Interesting Topic

The Committee on Professional Practices of the American Society of Mechanical Engineers has scheduled for discussion, "Should Manufacturers Provide Free Engineering Services." The discussion will be a part of the semiannual meeting, in Dallas, June 5-9.

Massachusetts to Join CEC

The Massachusetts Association of Consulting Engineers, which has voted to make application for membership in the Consulting Engineers Council, at the Oregon meeting, recently placed an advertisement in the Boston papers as an answer to politicians who do not

understand why they cannot shop for the services of consulting engineers on a price basis.

According to the ad of the Boston consultants, "Consulting Engineers are a coordinated group of specialists educated and trained to meet the highest standards of the engineering profession and licensed, as required by law, by the Commonwealth of Massachusetts, after rigid examination.

"Individually, Consulting Engineers are proficient as Civil Engineers, Electrical Engineers, Mechanical Engineers, Structural Engineers, Sanitary Engineers, Heating and Ventilating Engineers.

"Collectively they are highly skilled specialists in many fields of endeavor including safety and industrial engineering, foundation explorations, land boring, soil analysis, structural design, highway design, communications, electronics, hydraulics, air conditioning, sanitation, economic evaluations and analysis.

"... And just as the Medical Profession is governed by a stringent code of ethics, so too, do Consulting Engineers adhere to the rigid ethical principles as set forth by the Canons of Ethics of the Engineering Profession.

"It therefore follows that participation by Consulting Engineers in competitive bidding to secure professional engagements would be as much a violation of their code of ethics as it would be for sur-

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"Court decisions throughout the entire nation have declared that laws requiring competitive bidding do not apply to contracts for professional services.

"The wisdom of these legal rulings as they relate to Consulting Engineers is self-evident. First, because the cost to maintain such a diversified staff of professional engineers by public or private agencies would be prohibitive. Second, because the standard of wages paid by Local, State, and Federal Agencies precludes the employment of such highly skilled talents on a permanent basis."

President of the Massachusetts Association is Hugh Duffill, of Duffill & Associates. The Massachusetts Association now has 35 member firms, and although these firms are located in Boston, Duffill said members from any part of New England will be welcome.

Policy on Consulting Engineers

The American Society of Civil Engineers has submitted its recently adopted policy on the use of consulting engineers by government agencies to the Engineers Joint Council for review.

The policy states that "There is a proper and desirable place for both public engineering bureaus and for engineers in private practice in the performance of engineering functions in governmental agencies. It is only the degree to which either type of service can most efficiently be employed that is subject to determination in a specific instance. Such decisions are best left to the judgment of competent and experienced engineering administrators. It is believed inappropriate to attempt to establish rigid rules by legislation or similar regulation."

EJC has taken no action on the statement to date.

The more detailed report, as given to EJC, adds that "the Society's 44,000 members include

more than 13,000 professional engineers in the service of all levels of government, and at least 9500 engineers engaged as principals or employees in the private practice of engineering. With primary regard for the public welfare, and in the professional interest of these segments of membership, it is incumbent upon the Society to recommend a policy that will insure the most efficient and economical use of all engineering services . . .

"The Society acknowledges the advantages inherent in the establishment of engineering departments in public agencies provided that: (1) the permanent staffs of such agencies are of such size and competency as to handle engineering functions that are relatively uniform in character and volume; (2) regular appropriations are adequate for maintaining salaries and conditions of employment at appropriate professional levels; and (3) supervisory engineering personnel are represented at the management and policy-making levels of such agencies.

"The Society, however, considers it unrealistic, economically infeasible and at variance with good professional practice for public agencies to expand their engineering organizations during periods of peak demand, to retain key personnel beyond normally justifiable needs, and summarily to release large numbers of competent personnel during slack periods of operations. High overhead costs result from such practices, and are difficult, if not impossible, to allocate in the determination of true over-all costs to specific projects.

"The alternative to such cutbacks in slack periods is unjustifiable expenditure of public funds for the maintenance of oversized staffs. The permanent engineering organization in a public agency should be fitted to that character and volume of work which represent a minimum constant load.

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1958



1938

A few seconds after this picture was snapped in 1958, towering waves of Lake Superior smashed against this Armco Retaining Wall.

An Armco Bin-Type Retaining Wall was erected at the edge of the Minnesota resort village of Grand Marais in 1937 to protect a highway from damage by high waves on Lake Superior.

A year later, the worst storm in thirty years hit the community. From an account of the storm, "Although the waves pounded against the wall and broke clear over the roadway, no damage was done to the wall."

Twenty years passed. Then, in 1958, this Armco Wall received its worst buffeting of all in a particularly savage storm. Despite the hammering of tremendous waves, only three steel bins of the wall were slightly damaged. These were quickly repaired by a highway maintenance crew. Today, the 21-year-old wall is still giving good service.

For more information on Armco Bin-Type Retaining Walls for highway, railway, industrial and municipal applications, write for our new catalog. Armco Drainage & Metal Products, Inc., 6380 Curtis Street, Middletown, Ohio.

Some 20 years ago, the same Armco Wall was subjected to severe storm, with waves breaking 30 feet high.



Taken in 1937, this photo shows a construction crew assembling members of the Armco Wall installed at Grand Marais.

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staff to accomplish an assignment not practical of delegation to private engineers, then:

"(1) Short-term employment should be on a strictly temporary basis, without extension of civil service or tenure privileges normally available to permanent staff;

"(2) Long-term programs should be staffed with a view to gradual absorption of temporary personnel as replacements for permanent staff, to the end that there is no increase in permanent staff . . . for the minimum constant load.

"When the permanent engineering organization of a public agency is not capable of handling the increased work load, private firms should be employed for:

"(1) Unusual projects demanding special training and experience.

"(2) Emergency programs.

"(3) Projects of magnitude beyond the capacity of a public engineering bureau.

"Private firms are not restricted by seniority and civil service rules in hiring personnel with special skills and experience. Thus, they are better able to adjust their work forces to meet varying demands and to allocate such costs to specific projects . . ."

For further discussion of this subject, see Mason Lockwood's article, starting on page 88.

Minnesota vs. Socialism

The Board of Directors of the Minnesota Association of Consulting Engineers has voted to try to raise \$2500 to combat socialism in government. The Minnesota request pointed out that "The GAO [General Accounting Office] may be only interested in lower costs to the Federal government. Due to the 90-10 split between Federal and state participation and to the exclusion of state highway department overhead from Federal participation, 90 percent of consulting engineering fees would be paid from Federal funds. If this work were done by state highway departments, a portion of this cost

(state highway department overhead) would be eliminated from Federal participation. However, if the total engineering cost on a particular project is greater when engineered by a state highway department, the Federal government has not decreased its obligation in the program."

Employee-Employer Responsibility

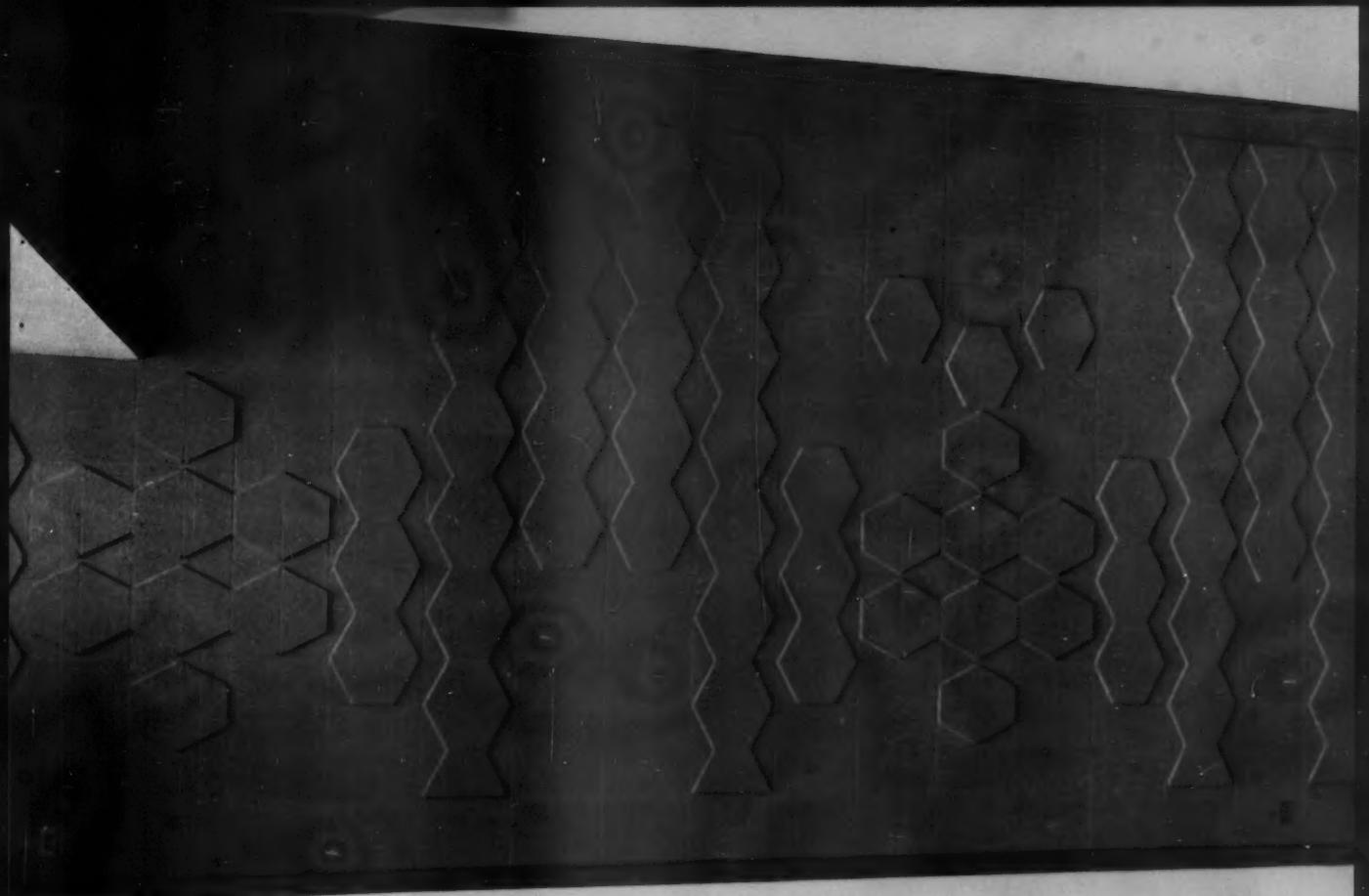
The Engineers Joint Council has completed a survey on the "safeguarding of proprietary rights" in an effort to determine who owns the work of an employed engineer.

The survey showed:

Pre-Employment Situations — About 44 percent of those questioned indicated that "the areas of specific information acquired in previous employment were discussed in employment interviews." Most of the employers indicated they recognize a mutual problem in safeguarding prior confidential information. But only a few asked the employee if he had prior obligations not to disclose trade secrets or patents.

Employment Agreements — Almost half of the employers require employment agreements of one kind or another covering patent assignments, nondisclosure of proprietary information, or both. "That employment agreements are so widely used for the protection of the current employer, while investigation of prior agreement obligations at the time of employment is so rare, points up an evident reliance on the engineer's responsibility to determine largely for himself what information he can carry and use from job to job," the survey added.

Confidential Information — While half of the employers felt their areas of confidential information were generally defined to the employees concerned, only 20 percent gave specific guidance to employees on this subject. "The comments indicated a general attitude that reliance was again placed almost solely on the individual to distinguish between proprietary



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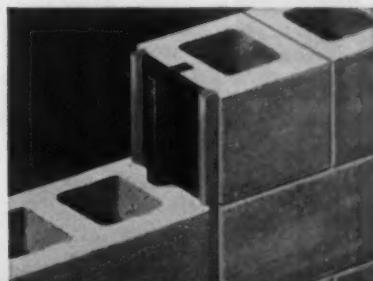
Two engineered products that meet a need. Dur-o-wal reinforcement, shown above, and Rapid Control Joints, below. Weatherproof neoprene flanges on the latter flex with the joint, simplify the caulking problem.

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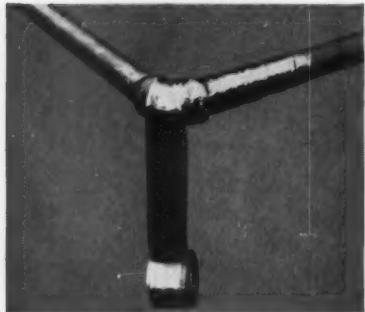
Masonry Wall Reinforcement and Rapid Control Joint

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and general information." About one-third of the employers reminded the employees of their responsibilities when they quit their jobs; only about five percent explained exactly what information they were not to reveal to future employers.

Proprietary Information — What is it? Patents obtained by an employee cause little trouble. "The disclosures and assignments implicit in implementation of patent agreements clearly imply the relinquishment of personal claims of the employee in these matters," the report added.

Trade secrets, however, do present a difficult problem.

Almost all those replying to the questionnaire sent additional comments, indicating that the determination of what belongs to the employer as contrasted with what constitutes knowledge and experience on the part of an employee is a generally recognized problem.

Professional Togetherness

Collaboration in the building arts was honored for the first time this year by the Architectural League of New York, which presented a Gold Medal of Honor to eight professionals for their work on the Westmore High School, in Daly City, California. Recipients of the Medal were Mario J. Ciampi, architect; Paul W. Reiter, associate architect; Isadore Thompson, structural engineer; Buonaccorsi and Murray, mechanical engineers; Harold A. Wright, electrical engineer; Lawrence Halprin, landscape architect; Anne Knorr, muralist; and Ernest Mundt, sculptor.

Winner of the 61st Gold Medal of Honor in engineering was Thompson, for the Vista Mar Elementary School, Daly City, California. The Silver Medal was won by B. M. Dornblatt & Associates, structural engineers, for the Phyllis Wheatley Elementary School, in New Orleans.

Ludwig Mies van der Rohe and Philip Johnson were the Gold Med-

al of Honor winners in architecture, for the Seagram Building, N. Y.

Speaking at the presentation dinner, which had for its theme "Achievement in the Building Arts," was John Noble Richards, president of the American Institute of Architects. Richards made a plea to artists and those in the building professions to work together for a future that would correct "the mess that is our man-made environment." He referred to the recent changes in the Philadelphia building code requiring one percent of construction costs for art to enhance the structure as one of the "first robins, heralding a new spring."

Seen Around Headquarters

The consulting engineers slipped again. Display of the new Engineering Societies Headquarters, at the American Society of Mechanical Engineers' reception room, lists the architects—Shreve, Lamb and Harmon—but no mention is made of the consulting engineers on the Engineers Building.

Sue State Board

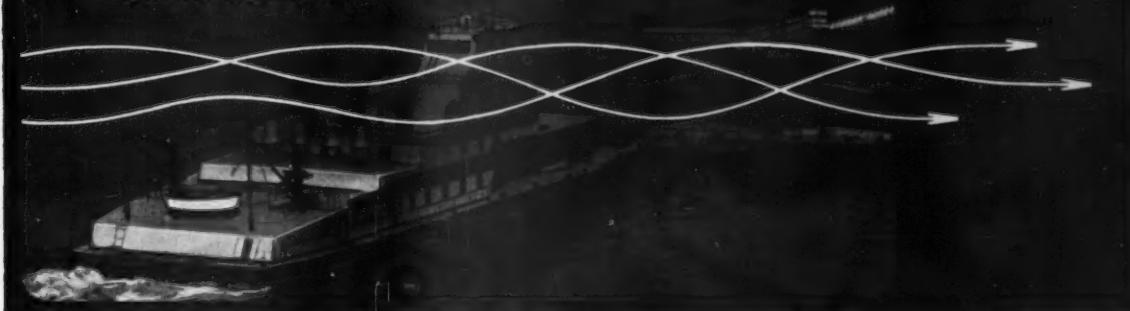
Last year, the Louisiana Legislature passed a resolution authorizing the State Board of Registration for Professional Engineers and Land Surveyors to waive the usual registration requirements for 30 days.

Reason for the waiver was to allow some state employees to gain easy registration. Civil Service regulations required these state employees to be registered before they could qualify for promotions and better pay.

Fifteen Louisiana engineers brought suit in District Court in Orleans Parish against the State Board, contending that allowing unqualified persons to register under the Legislative waiver was handicapping the consulting practices of the complainants. The suit was led by the Gulf Institute of Consulting Engineers, and later endorsed by the Louisiana Engineering Society and the Louisiana

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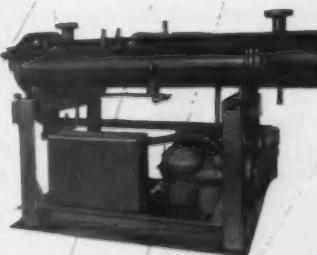


Huge 180 foot Federal Barge Lines towboat, the *United States*, has 50% greater horsepower than the largest towboat on the rivers. It can push 40 barges, totaling 1/3 mile, or 300 ft. longer than the "Queen Elizabeth".

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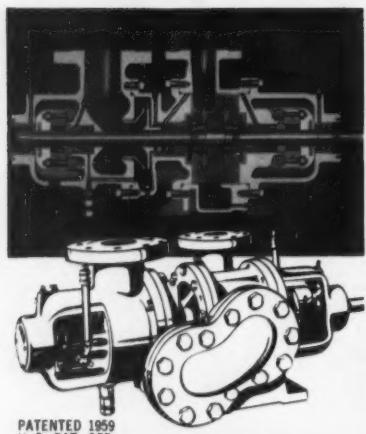
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Section of the American Society of Civil Engineers.

The court is petitioned to declare the Legislative resolution invalid and to enjoin the State Board from registering applicants unless they are qualified fully to meet requirements of the state registration act.

Efforts also are being made to get State Civil Service groups to allow promotions in subprofessional grades without the requirement of engineering registration.

Chandler Retires

E. Lawrence Chandler has retired as assistant secretary of the American Society of Civil Engineers, effective March 31, but is continuing in his post as ASCE treasurer.

Chandler, who has been with ASCE since 1944, also is treasurer of three other organizations — Engineers Joint Council, Pan American Federation of Engineering Societies, and U. S. Committee of the World Power Conference.

No successor has been named for Chandler's position as ASCE assistant secretary. Some staff reorganization is likely, and there is a possibility the title of assistant secretary may be discontinued.

Short ASHRAE Terms

Being president of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers currently is a short-lived proposition. Because of agreements made during the ASHRAE formation by merger of the American Society of Heating and Air-Conditioning Engineers and the American Society of Refrigeration Engineers last year, presidents are serving only six-month terms until all officers of the two prior groups have had their time in office.

Daniel D. Wile, vice president of Recold Inc., in Los Angeles, took office as president at the recent semiannual ASHRAE meeting, in Dallas.

In June, Walter A. Grant of Carrier Corporation, will become

president at the Annual Meeting, in Vancouver. First president to serve for a full year will be the man who takes office at the 1961 Annual Meeting, in Denver.

Austria Celebrates

The 75th Anniversary of Engineering and Architecture in Austria will be celebrated next month, with a full commemorative program to be held in Vienna, June 1 through 4. A representative of the American Society of Civil Engineers will be among those attending the Diamond Jubilee of Engineering.

Engineers' Hospitality

For years, American engineers have been able to go abroad and be treated like kings by their European counterparts while, all too often, foreign engineers visiting New York City find themselves totally on their own.

The Metropolitan Chapter of the American Society of Civil Engineers decided to do something about this situation. According to Michael N. Salgo, section president, an "Engineering Visitors Committee" now is in operation.

The committee first made a survey to determine how many and what kind of visitors could be expected. It then sent questionnaires to engineers, magazines, government groups, and universities to see who was willing to help. The response showed New Yorkers to be more hospitable than reputed. Among those complimenting the ASCE group on the committee formation was the State Department, which pointed out that the need for such a committee has "long been apparent."

For the time being, the committee is confining its efforts to making arrangements for inspection trips by the engineers — both as groups and as individuals. Engineers at the sites visited will act as tour guides. Later, the committee hopes to furnish volunteer escorts from the Metropolitan Section membership. □

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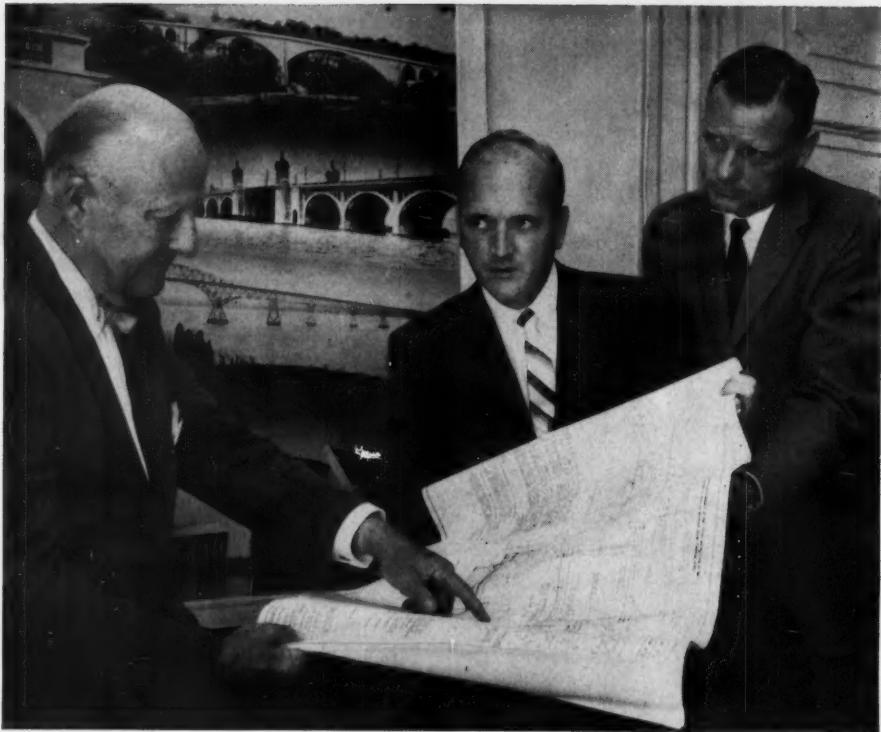
79

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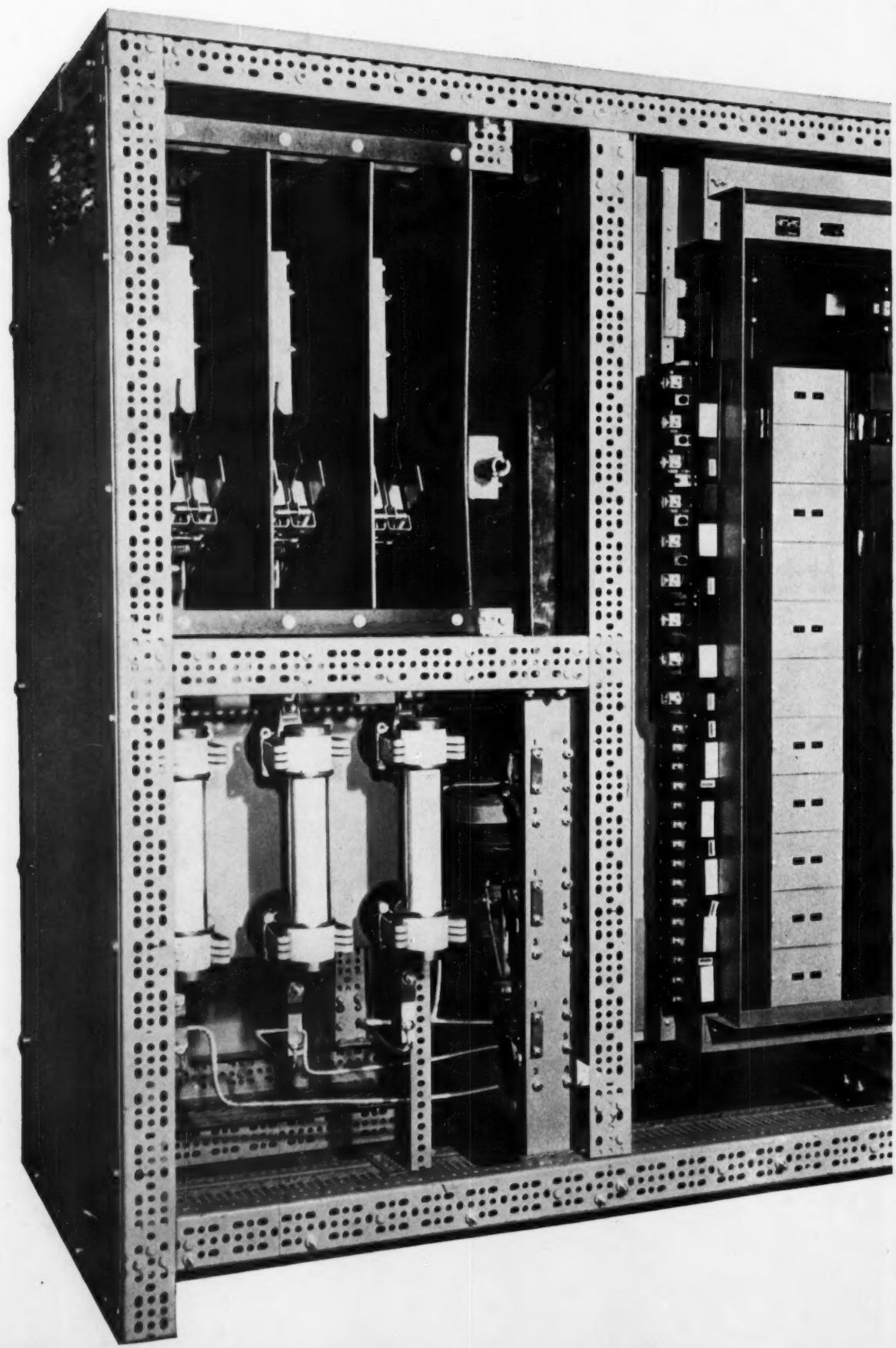


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Type H insulation (in units up to 5000 volts) has enabled General Electric engineers to design these new one-piece centers up to 23 per cent lighter and up to three feet narrower. At the same time, the new G-E unit gives you an *ideal balance* of quiet operation, easy installation features and safe, reliable operation.

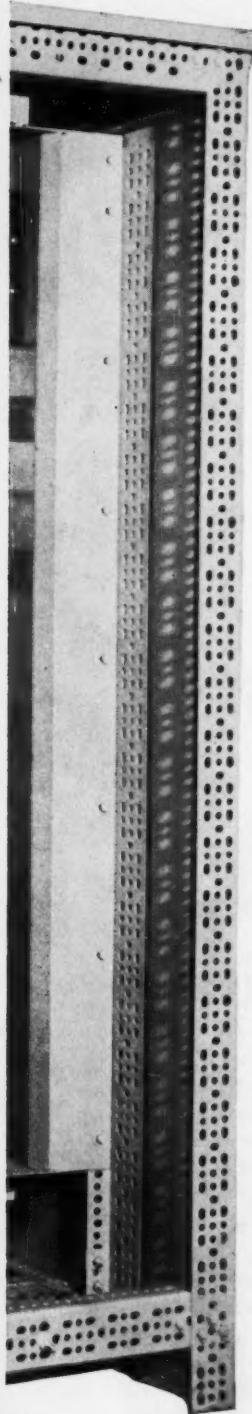
EASY TO BUY, EASY TO INSTALL—G-E Integral Distribution Centers are ordered, shipped and installed as single units. No special installation tools are required.

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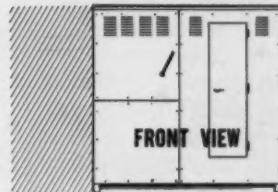
Why not specify the distribution centers that give you plenty of "elbow room"—General Electric's new Integral Distribution Centers. Want more information? Send in the coupon below or contact your nearby General Electric Representative.

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J. Donald Kroeker is well qualified to speak on the subject of free engineering. Prior to opening his own consulting office in 1936, he was engaged in the design and sale of domestic heating, industrial drying, and heat processing equipment. Having walked both sides of the engineering street, he has developed some rather strong opinions on the subject. Technically, Kroeker has an outstanding reputation in the field of heat pumps. He has been the designer or consultant on four of the world's five largest installations.

Presenting . . .

Our Authors



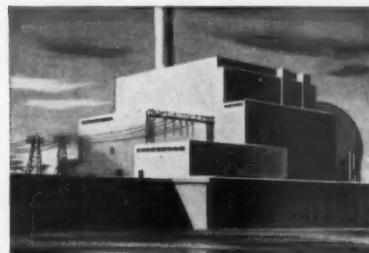
W. A. Tripp, chief electrical engineer of J. G. White Engineering Corporation, is already known to CONSULTING ENGINEER readers. In this issue, Tripp draws on his broad electrical background to explore the mysteries of phasing. A life Member of the American Institute of Electrical Engineers, Tripp is a 1922 graduate of MIT and has spent his entire professional career in the consulting field. Like most authors, writing on a familiar subject, he was amazed at the length of his present piece. It is, however, both pertinent and practical.

Mason G. Lockwood, as a past president of ASCE, is well known to engineers. Entering private practice as a partner in his present firm in 1935, he has had ample occasion to study the encroachment on private practice by government employed engineers. From the vantage point of experience gained through active participation in many engineering societies, Lockwood speaks knowingly of the problem. His own firm numbers an engineering staff of 80 or more, with headquarters in Houston, and offices in Victoria and Corpus Christi.

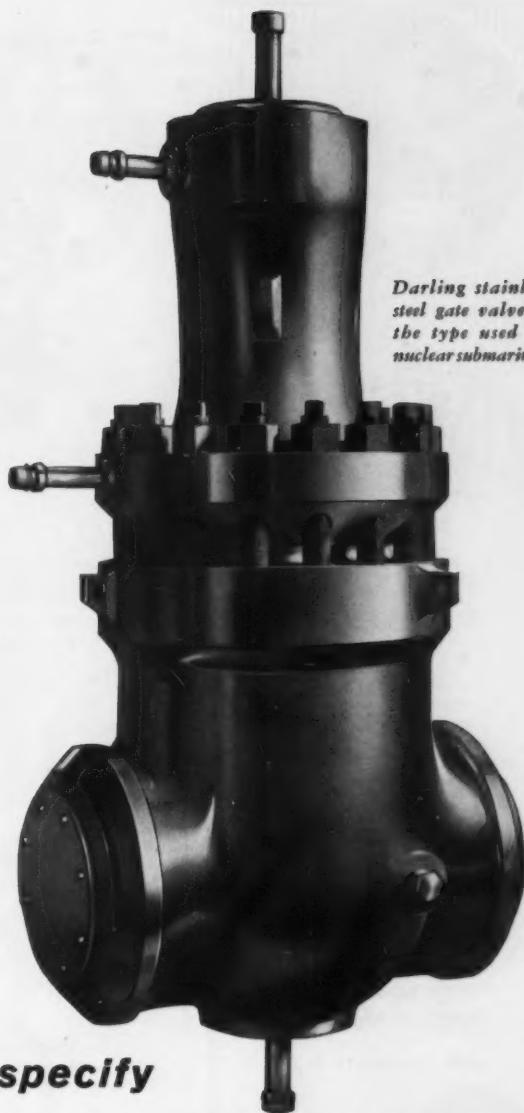
Daniel F. Schauss is an expert on piping design, and is currently a senior draftsman in the Birmingham office of The Rust Engineering Company. He joined Rust at Oak Ridge, where he worked on piping design and field inspection of subcontract work for insulation. Since 1936, Schauss has been interested in photography, and it has become a paying hobby. He is a member of the Birmingham Camera Club, past president of the Rust Camera Club, and is a member of the Photographic Society of America. It is natural that his in-



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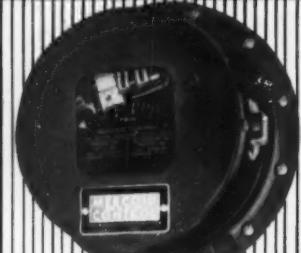
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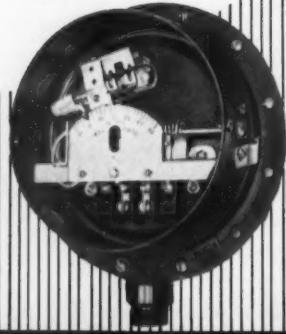
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terest in photography should take a practical turn, and the ideas he has developed for its use as a drawing technique in piping or equipment layout are worthy of study.



M. Zar is a graduate of Armour Institute of Technology (now Illinois Institute of Technology) in civil engineering. Except for a brief period spent in the design of vessels for the Bureau of Ships, he has been with Sargent & Lundy since 1942. He is presently an associate member of the firm. As a project engineer, he has been interested in the rapidly expanding application of high strength bolts. His article deals with some recent field testing by Sargent & Lundy, which resulted in a detailed specification for the installation and inspection of A-325 bolts.



Robert E. Hollick has been concerned with water for a good portion of his engineering career. He spent a number of years with the Tennessee Valley Authority on various hydraulic projects and then did design work for the Panama Canal in connection with the protection of the existing canal and

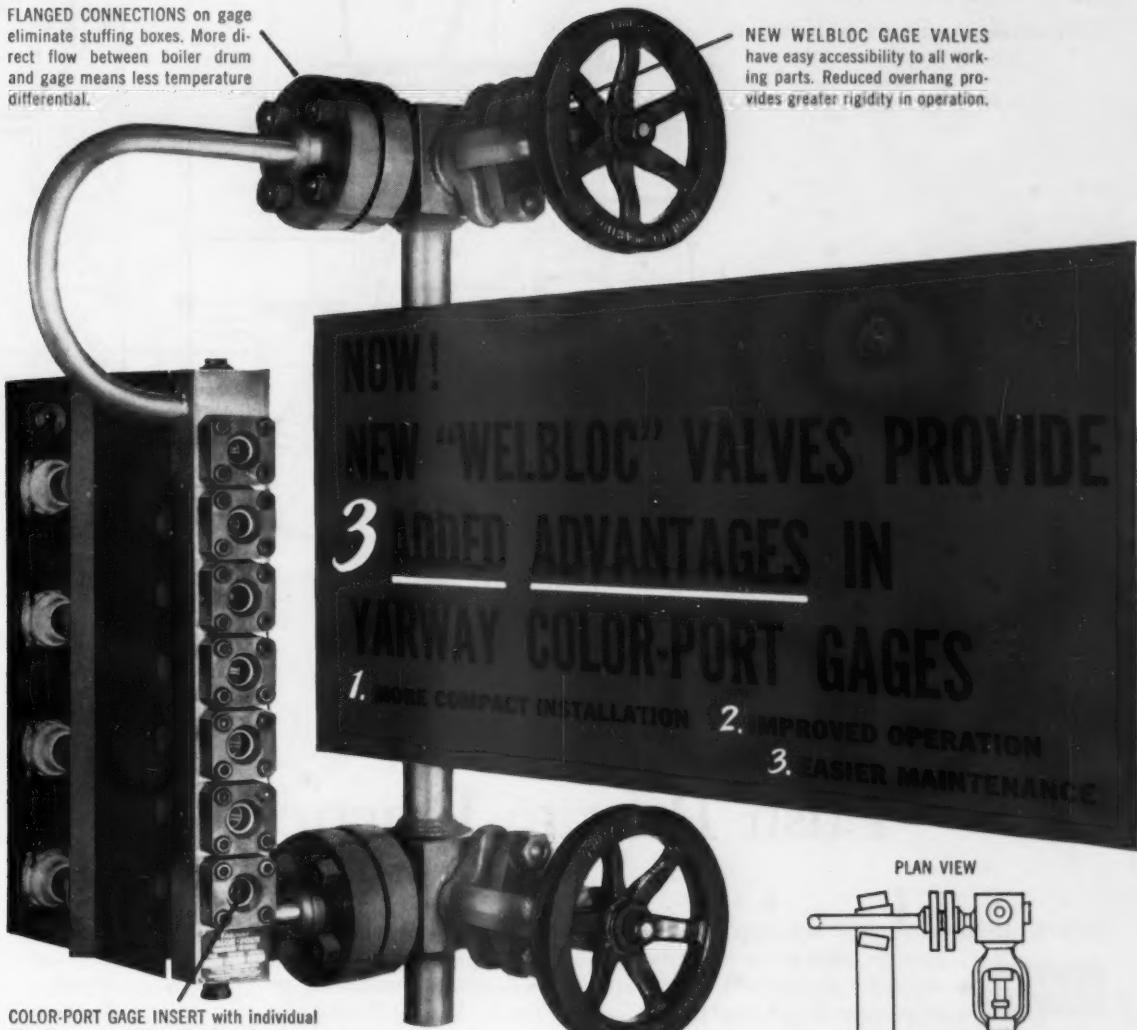
the design of the Third Locks. Since 1948 he has been associated with the International Engineering Company, Inc., and is presently in charge of the structural section. Since joining International he has acted as a project engineer for the design and construction of the Port of Santo Tomas in Guatemala, and also as project engineer for Hwachon Dam. More recently he has worked on a number of hydro projects both at home and abroad, and has done considerable development work on offshore structures for the petroleum industry. He has drawn on this experience for his review of offshore structures.



Herbert S. Kindler graduated from the Massachusetts Institute of Technology in 1948. He is a registered professional engineer, licensed in the State of New York, and has written a number of technical articles relating primarily to instrumentation in the petroleum industry. Before joining the staff of the Instrument Society of America, Kindler was associated with Black, Sivalls & Bryson, Inc. as head of their gasoline plant engineering section. During the last four years Kindler has served on planning committees for over 30 technical conferences. Based on this broad experience he has written a book, *Organizing the Technical Conference*, which will be published by Reinhold in June. One chapter is of particular interest to consulting engineers, and arrangements have been made for CONSULTING ENGINEER to carry it on an exclusive basis. ▲▲

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Yarway's latest improvement in boiler water level gage design—"WELBLOC" GAGE VALVES—gives you these new advantages:

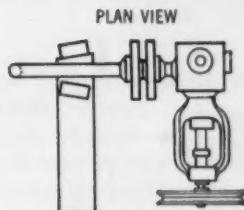
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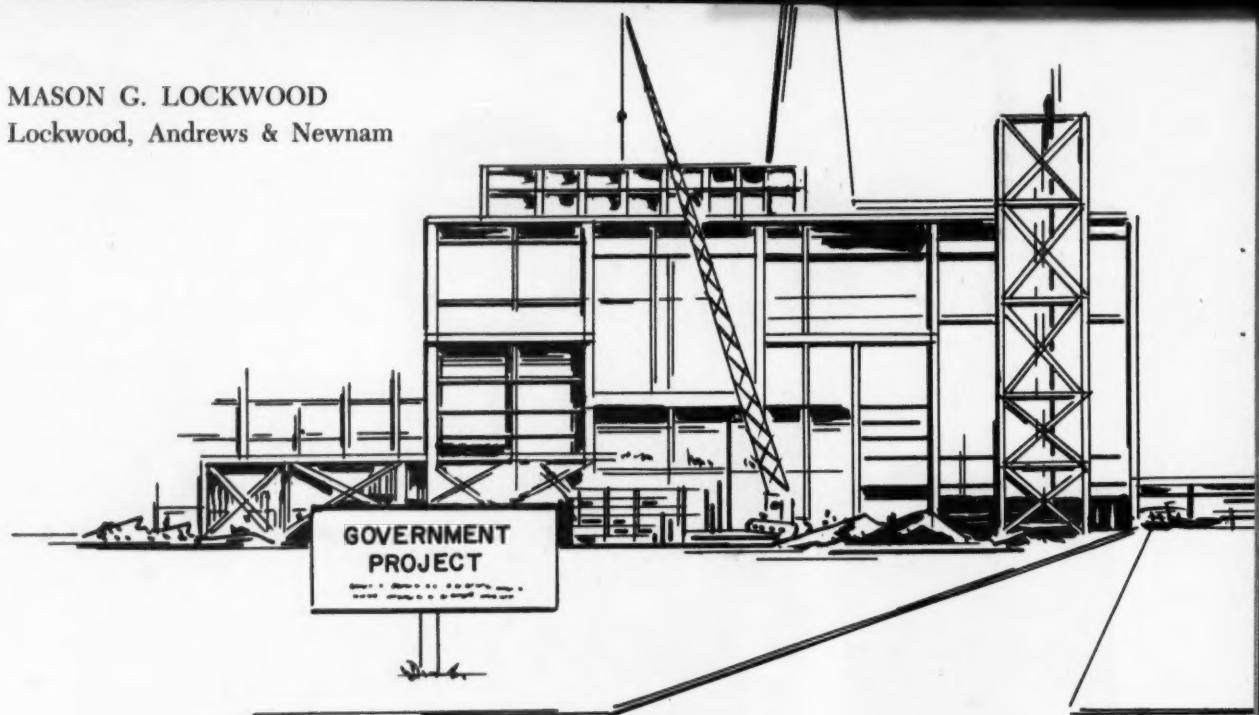
MORE COMPACT DESIGN reduces installation space requirements up to 40%. Note: illuminator may be mounted on either face of gage insert.

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How We Can Resist When They Try to Push Private Practice Out

CE exclusive DEFINED NEGATIVELY but simply, private enterprise engineering is engineering not done by salaried government employees. Relatively, private enterprise engineering for government projects is diminishing; government engineering from township to international levels of government is eroding private enterprise engineering. Thus all engineers are affected.

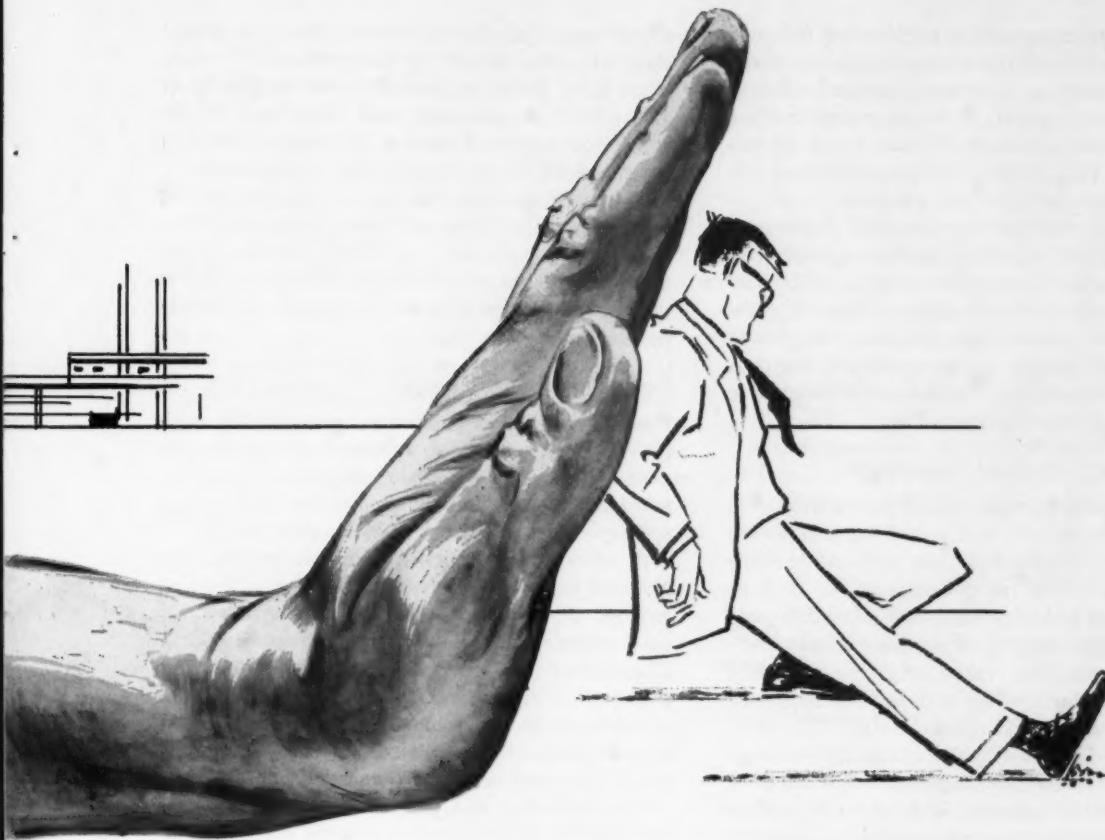
Trend Is Wide Spread

Most discussions in the current literature leave the impression that this trend is a selfish concern of engineers in private practice — consulting engineers — and that the problem is primarily at the Federal level. This is a misunderstanding shared by many engineers. The same trend widely recognized as existing in Federal government is just as pronounced at local, municipal, and state levels. Not so readily understood, because of the fewer engineer participants, is the fact that the same trend is running wherever the heavy hand of the United States government, through our vast mutual aid and economic cooperation programs, touches foreign countries. In

other words, this trend exists throughout the Free World, since the United States, through its peace and security motivated programs, has become a sort of Wholly Roamin' Empire. Among the great international institutions, only the World Bank is successfully opposing government engineering.

To be sure, this government erosion of private enterprise engineering is of most immediate concern to engineers in private practice, for it threatens their economic survival. So far as the profession as a whole is concerned, government erosion strikes in a destructive way only at professional ideals. No engineers — whether in government, in industry, in education, or in private practice — stand to be elevated by the forces moving toward socialized engineering. Socialization is a great leveler — and 20th century engineering has had leveling enough. It is more in need of incentive and reward for the able and the worthy.

So accustomed have we become to the inexorable and apparently irreversible expansion of government, and so complacent or defeated are we by the ways of bureaucracy, that we seldom do more than complain to each other. Consulting engineers, who



clearly must — and in the public interest should — take the lead for the profession in arresting these trends, have up to now done a sorry job of representing themselves and their profession.

Perfectly sensible and well intentioned city councilmen, for example, have been known — as they struggle with fund limitations which fall far short of public needs — to point accusingly at items of a few hundred to several million dollars that have been paid as fees to consulting engineers. These harried councilmen then propose that all this money be saved hereafter by "making our own engineering staff do this work." This same astoundingly naive and nonsensical philosophy sometimes prompts leaders in state government, and even in the United States Congress, to similar suggestions — and all too frequently, to act on the basis of such appallingly phony economic logic. Until now, there really has been no concerted effort to expose these wild and unrealistic efforts to save on engineering by excluding consulting engineers from government projects.

It is amazing that consulting engineers acting together have not already taken steps to reduce this fallacious reasoning by adopting at least a few

of the simple and more obvious expediencies. For example, such expressions as "engineering fees" and "consultants' fees" are still loosely used. Yet, over and over it has been demonstrated that the word "fee," as it relates to engineering or architecture, conveys to the lay mind the idea of huge per diem pay for expert advice or testimony. A fee of \$100,000 for consulting engineering services may suggest to the layman a \$90,000 personal profit and \$10,000 cost. Misinformation of this sort constitutes a self-inflicted wound.

Education Required

It is time, too, we told the public about the vast change in consulting practice. We should try to find more generous terms that are more accurately descriptive of our work. "Consulting engineer" was a perfectly apt term when it was coined. It is now so universally established that it probably cannot be and probably should not be replaced, and perhaps that is satisfactory so long as it is understood by those using and hearing it. But unfortunately most of the public and most of our clients do not know what we mean when we say "consulting engi-

neer." Most private practice engineering today is done by professional organizations made up of engineers practicing as a group of principals in a partnership or a corporation. We must explain what we do and how we do it. We must not let the distinguished title, "Consulting Engineer" limit the public's understanding of our practice.

The point is that these professional businesses, while dealing exclusively in professional services, are subject to the same burdens of payroll, overheads, and taxes as other businesses. There is nothing professionally deteriorating about recognizing these facts and turning this recognition to our own purposes by eliminating the presently destructive connotation in the public mind.

Governmental Units Need Consultants

Government reliance upon the engineers in private practice has been well established for a half-century. Though the armed services and certain other agencies of the Federal government (as well as many state and local agencies) still depend heavily on private engineering firms for design and supervision of construction, many other governmental agencies increasingly prefer to depend on their own continuously augmented technical staffs. The justification offered for this is almost always based on the claim that the engineering costs less when done by government employees. This claim is seldom valid. But there are those who would legislate private enterprise engineering out of government.

Nearly all critics of private practice engineering on government projects profess to believe, and some really do believe, that to substitute staff engineering is to save public money. While the opposite is more often true, comparable costs are seldom available.

Engineering on public works for general planning, certain types of design, much construction supervision, and most maintenance ought to be done by salaried engineer employees of government. So also should the administration and fiscal control of the engineering aspects of undertakings financed by public income. This is necessary for continuity, security, and the general welfare. Thus, it is rather beside the point to ask whether those functions can be handled more expeditiously or at less cost by engineering firms in private practice. Responsible engineering firms never seek to replace or to share in manifestly appropriate staff-engineering functions of government.

Fundamentally, there is only one justification for private engineering on government projects: the public advantage. Engineering for a public facility that can be done to the better over-all advantage of the people by staff engineers — considering economy, speed, quality, the maintenance of the most effective structure for emergency mobilization of

engineering, and all other relevant factors — clearly should be done directly by government. But much, if not most, design engineering now being done at all levels of government by staff rather than private enterprise engineers cannot be justified on this basis. Indeed, much of it just cannot be justified.

The inexorable forces of bureaucracy are gaining what the public in general, and private enterprise engineers in particular, are losing. To the extent that these tides of engineering by government erode the field of private practice, they erode the whole engineering profession.

Comparative Cost Surveys

Despite deficient organizational unity in the engineering profession, there is hope in the single-purposed (if severally directed) counterattack now being made to maintain the proper role of the consulting engineer in the design of public works.

By comprehensive questionnaire techniques, the National Society of Professional Engineers has just secured significant data on engineering costs for government work done by private engineering firms. These cost data — covering some 1400 engineering contracts involving over \$4 billion of construction — will soon be published, and they should afford an authoritative basis for testimony before committees of Congress and other interested bodies.

Corresponding cost data on engineering performed directly by government staffs is much more difficult to obtain. Few agencies have accounted for their engineering costs in ways that permit rational comparison with costs for equivalent work done by consulting engineers. Only a few state highway departments, for example, publish engineering costs meaningful for comparison.

The Engineering Division of the American Road Builders' Association — through its Public Affairs and Engineering Services Committees — has assumed the somewhat prodigious task of developing, from the reports and other official documents obtainable from 42 highway departments of the first 48 states, representative cost data on highway engineering as performed by department staffs. This is to be compared with cost data on engineering supplied by private concerns during the late toll road building era. At this writing, these studies of the ARBA Engineering Division are not quite complete. Upon completion, however, they will reveal costs for complete engineering services by highway departments (in the states where such costs are essentially determinable) nearly twice as high as for substantially comparable private enterprise engineering on 18 toll roads, the aggregate construction cost of which exceeded \$3 billion.

The fact that highways were made available much earlier through the use of services of engineers in

private practice is, of course, not subject to economic evaluation. But to ignore this immeasurable public benefit is to be ridiculous. The forthcoming ARBA report will illuminate this factor strikingly by pointing out that one year's extension of completion time on the toll roads would have meant an increase of at least \$350 million in financing, merely to capitalize interest for the additional year.

Other Association Activities

Both the American Institute of Consulting Engineers and the Consulting Engineers Council are actively working to set the record straight and clear up the increasingly popular misconception that over-all savings are achieved through government engineering. Admittedly, AICE and CEC openly represent the private practice point of view. Admittedly, AICE and CEC members have a distinct self-interest. But fortunately, the most unselfish among these members can in good conscience advocate their cause. Their cause, in this instance, is the public cause also.

The American Society of Civil Engineers (and perhaps other Founder Societies) is concerning itself with this professional problem. ASCE represents engineers without reference to their type of employment. Many of its members are employees of government, industry, or educational institutions. Many others are principals or employees of firms in private practice. Despite this divergence of membership, ASCE has struck so unerringly at the heart of the issue involving the relationship between public and private engineering services in governmental agencies that the ASCE statement would seem to preclude disagreement:

"There is a proper and desirable place for both public engineering bureaus and for engineers in private practice in the performance of engineering functions in governmental agencies. It is only the degree to which either type of service can most efficiently be employed that is subject to determination in a specific instance. Such decisions are best left to the judgment of competent and experienced engineering administrators. It is believed inappropriate to attempt to establish rigid rules by legislation or similar regulation."

Recommendation to Congress

Engineers in private practice also are prepared to suggest strongly that Congress consider amending present regulations to the extent that any use of consulting engineering services which proves more economical than the use of government employee engineers be not only permitted but encouraged as being manifestly in the public interest. The emphasis in the laws, and especially in some of the administrative regulations of the agencies, is nearly

all negative with respect to the use of private engineering. Consider, for example, how difficult it is, under the rigid interpretation of present regulations of the Bureau of Public Roads, for the states to justify engagement of private engineering firms. These regulations provide that:

"The services of consulting engineers and private engineering organizations may be utilized on a contract basis for design, preparation of plans, specifications, and estimates, and in special cases for construction engineering other than general construction supervision, only under one or more of the following circumstances:

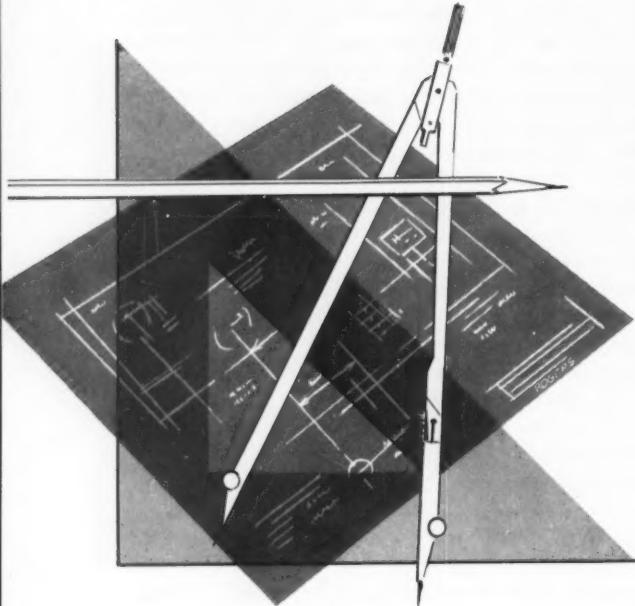
- (i) the work is of unusual character requiring highly specialized knowledge and experience;
- (ii) it would not be possible to enlarge the staff of personnel available to the State so as to perform the engineering services on the project within a reasonable time; or
- (iii) the State has a program substantially larger than normal or expected in future years and it desires to employ consulting engineers rather than build up its organization for a comparatively short period."

Costs Should Govern

Instead of this, the decision as to whether to use public or private engineering services should turn on the question of comparative costs of the two. Private engineering interests would hardly urge this point of view if they were not convinced that analysis of comparable fiscal data will demonstrate that consulting engineering services are nearly always less expensive than engineering services provided by government employees.

The present issue is symptomatic of a potentially deadly and economically crippling conflict between the free enterprise system and its bureaucratic antithesis. Private enterprise neither wants nor has any right to government work that can be more economically performed by civil servants. But advocates of engineering by government employees have never suggested that the principle of relative economy be invoked. Rather they have adopted as their rallying cry the false claim that "the government can do it cheaper."

If, through bureaucratic demagoguery or honest misunderstanding, or both, the public is convinced that there is diminishing justification for free enterprise engineering in government, we can only blame consulting engineers themselves. It is our responsibility, and this is our opportunity — probably the only one we will have — to meet forcefully and successfully the crisis of private enterprise engineering. If we fail, we stand to lose twice — once as professionals, and once as taxpayers in common with the rest of the American public. □□



Analyzing Phase Connections

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PHASE CONNECTIONS always have been a problem to the electrical engineer.

CE exclusive
However, the nature of the problem has changed through the years. In the past, it was mainly a matter of recognizing the various 2-phase and 3-phase connections, and the ways they could be related. Whole areas were built up in these systems, and as they expanded and grew toward one another, they had to be combined, thus requiring the use of combining connections.

Today, the 3-phase system has practically taken over the field. However, the matter of phase connections still creates problems because of the greater integration of equipment and its sheer physical size. In the past, making connections within a system created few problems. It was a simple matter to reconnect a bank of transformers, or switch a couple of leads. Today, the widespread use of the 3-phase transformer, plus the popularity of metal-clad and other forms of preassembled gear, make it necessary to plan the physical relationships and orientation of much of the major equipment well in advance. Even when there is some freedom in the way connections between equipment can be made, the physical size of the interconnections themselves often is so great, owing to the concentration of power, that severe limitations are imposed on just how much the interconnections can be adapted or altered.

The cost of correcting a simple phasing error can run from a nominal charge to upwards of

several thousand dollars. On a big job it ordinarily will not be enough to upset the cost estimate, but it always is embarrassing to ask for funds to correct a mistake. More embarrassing is the fact that errors in phasing are apt to go unnoticed until the equipment is connected and prepared for operation. By that time, the least error or delay is magnified in importance and is evident to everyone.

What Phasing Is

To the electrical engineer phasing means the relationship between the voltages at the terminals of the various pieces of equipment, including the terminals of some items of equipment individually. The term phasing has not been accorded the dignity of a definition in the professional standards, although there are definitions for various aspects of it. The paragraph numbers in ASA Standard C42.05 (still available only in the complete bound C42 issue of 1941) of several terms which relate to phasing are: 05.05.280 phase, 05.05.285 phase angle, 05.05.290 phase difference, 05.05.295 angular phase difference, 05.05.296 angle of lead, 05.05.297 angle of lag, 05.05.300 synchronism, 05.05.305 quadrature, and 05.05.310 opposition.

The most significant of these definitions is that of the fundamental term "phase" which states, "The phase of a periodic quantity, for a particular value of the independent variable, is the fractional part of a period through which the independent variable has advanced, measured from an arbitrary origin. In the case of a simple sinusoidal quantity, the

origin is usually taken as the last previous passage through zero from the negative to positive direction. The origin is generally so chosen that the fraction is less than unity.

The "periodic quantity" is the fundamental frequency component of the voltage, a simple sinusoidal quantity. The "independent variable" is time. The significance of the other definitions will be readily apparent. Collectively, the entire group of defined terms describes much of the area of interest covered by the term "phasing."

In a 3-phase system — defined in ASA Standard C42.35, paragraph 35.40.060 — we are dealing with three voltages. Assume that they are the line-to-neutral voltages OA, OB, and OC; equal in magnitude and 120 electrical degrees apart; with OA reaching a particular "phase" first, followed by OB and OC in that order. The use of more than 3 phases in power work is uncommon except for transformation from a.c. to d.c. by the use of rotary converters or rectifiers.

Vector Representation

It is convenient to represent voltages by the customary vector arrow symbols. The conventional method assumes rectangular coordinates, with the zero position, or origin, for angular measurement being horizontally to the right from the center of the coordinates, and the vector arrows rotating counterclockwise. The instantaneous magnitude of the voltage represented by any vector is its projection on the vertical axis of coordinates, the value being positive when the arrow points up and negative when it points down. The vectors for the assumed 3-phase voltages for the instant when voltage OB is a positive maximum would be as shown in Fig. 1.

All too often the conventions used in representing vectors are assumed but not spelled out. This is a dangerous practice. For example, in vector rotation, the use of clockwise rotation is not unknown. On one occasion, when designs for a new power plant were being prepared, it was found that old company records on the system stated clearly that voltage vector rotation was clockwise. This

convention was followed for the new plant, and it created quite a problem for designers over a period of several months. One of the favorite devices used was to read prints of vendors' drawings by holding them up to the light. Reading these drawings from the reverse side of the sheet or reading a mirror image of them, readily established the proper vector rotation relationships.

Diagram Methods

The vectors shown in Fig. 1 have been designated to represent line-to-neutral voltages. Thus, they would represent the voltages produced in the windings of a wye-connected generator or transformer. If there were no wye- or star-connected equipment, but only delta-connected equipment on the system, these voltages would be somewhat fictitious, but still very real because of the capacity of the system to ground. The voltages between buses, however, are always real. These are the voltages between the ends of the arrows in Fig. 1, and are designated as BA, CB, and AC (or their reverse).

These voltages are formed from Fig. 1 simply by drawing the lines between the ends of the vector arrows, as shown in Fig. 2, or by drawing the parallel lines from the center of coordinates outward, as in Fig. 3. The method of Fig. 3 is the pure mathematical method, but it lacks the realism of Fig. 2 in which the vectors are drawn between the actual points involved. Vector rotation is taken care of by assuming Fig. 2 to spin like a pinwheel about the point O. All vectors will pass through their phases correctly, even though they have not been drawn in radial form from point O out. Thus, the determination of positive and negative is given in terms of the direction of the arrow, rather than the apparently simpler basis of location above or below the horizontal axis of coordinates.

In the pinwheel method, which becomes more effective as the vector diagram becomes more complicated, the person familiar with diagrams will have no difficulty in reading the instantaneous value of AC as zero since it is horizontal, and CB as positive or BA as negative, even though they are

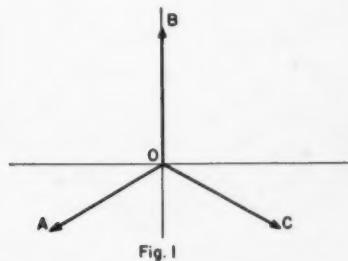


Fig. 1

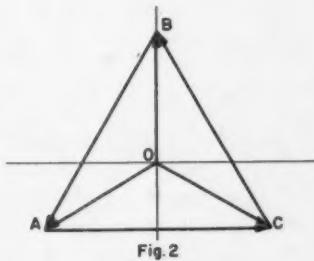


Fig. 2

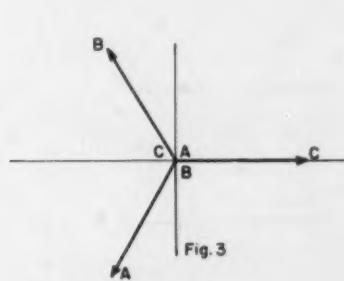
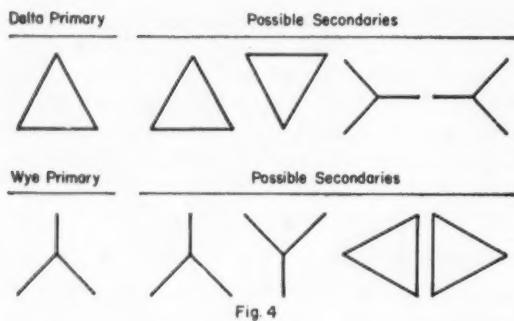


Fig. 3



partly above and partly below the line. One of the advantages of the use of vectors is that one can perform geometrical gymnastics with the vector diagrams, and the transpositions through which they are put will have their counterpart in actual physical transpositions.

Transformer Phasing

Transformers constitute a major phasing problem, and they illustrate the way in which vectors can give a picture of actual physical conditions. The problem is not much different for a 3-phase transformer or a bank of three, single-phase transformers. With a 3-phase transformer the connections are made in the factory inside the case, and any subsequent changes constitute a major operation. With single-phase transformers it is necessary to know whether they are of additive or subtractive polarity, the standard being subtractive in the usual power sizes. With 3-phase transformers polarity has no meaning, but the all-important thing is the winding diagram, usually inscribed on the nameplate.

Assuming a regular 2-winding hook-up, with either a 3-phase transformer or a bank of three, single-phase transformers, there will be two vectors for each phase. One will be for the primary and one for the secondary voltage, giving six vectors in all. If they are to be combined in two groups of three, one comprising the three primary and one

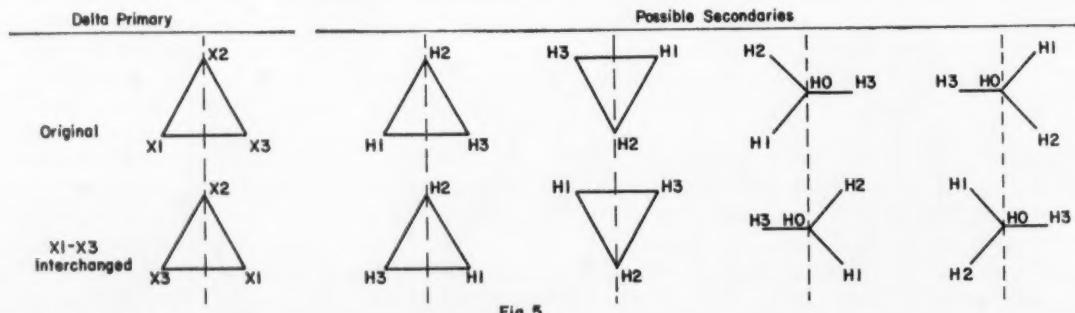
the three secondary vectors, we can connect the primary windings in either delta or wye. When a balanced 3-phase source is connected, the vectors are established for the primary windings. This can be illustrated by assuming the bus voltage of Figs. 2 and 3 connected to the primary transformer windings of Fig. 4.

At the same time, there result three vectors for the voltages of the secondary windings, each parallel to its related primary vector, which can be combined in a number of different ways. However, useful delta or wye connections are required. For each of the two arrangements, that is, primary delta and primary wye, there are four possible secondary combinations — two deltas and two wyes. These are shown in Fig. 4. Actually, more than two of each could be drawn geometrically but they would have to be read for clockwise rotation and when redrawn for counterclockwise rotation they would be the same as those already drawn. Fig. 4 has been drawn without regard to relative size (magnitude of voltage), since the primary concern here is with phase relationships. However, when the vectors are drawn in their proper relative size, their geometry is as truly representative of voltage magnitude, and all combinations thereof, as it is representative of phase position.

Results Important

A study of Fig. 4 yields some worth-while information. When the primary to secondary relationship is either delta-delta or wye-wye, there always is a combination in which the secondary is in phase with the primary. When the primary to secondary relationship is either delta-wye or wye-delta, there never is a combination in which the secondary is in phase with the primary. The angle difference is 30 degrees and can be in either direction. Between the two deltas or two wyes of either, there is a difference of 60 degrees.

With respect to the 60 degree angle, Fig. 4 looks more as though it were 180 degrees. This actually is so if individual phase voltages are identified.



However, it is common to disregard phase identity in this instance, and since the phase angle is 120 degrees the result is identified as the total less one phase shift or 180 degrees minus 120 degrees, which is 60 degrees. In the delta-wye or wye-delta relationship the 30 degrees in either direction is arrived at in like manner.

The present American industry standards for power transformers do not recognize all the combinations shown in Fig. 4. They recognize only the in-phase delta-delta, the in-phase wye-wye, and the delta-wye or wye-delta where the high side leads the low side by 30 degrees. This is unfortunate, for it may be a factor in the occurrence of numerous errors in phasing. The delta-delta and wye-wye connections with 60 degree shift are rare. However, the delta low-tension, wye high-tension combination is a very common transmission connection, because of the several benefits of having a delta connection in the bank. Thus, most of the transmission systems are out of phase with their associated generating systems by 30 degrees. With the independent historical development of many systems, out of phase position cannot be predicted.

The British standard for power transformers, No. 171, recognizes all the possible combinations shown in Fig. 4, even those that admittedly are rare. Others not considered here, involving zigzag low-tension connections, also are recognized.

The connections discussed thus far are those between the phases of either a 3-phase transformer or a bank of three, single-phase transformers. Errors apt to occur usually result from failure to interpret properly some existing phase angle difference. In a 3-phase transformer, the connections affected are inside the case. Not only will the process of correction require opening the case, but often the leads which must be interchanged will require extensive re-fabrication, if not complete replacement. If a bank of single-phase transformers is involved, the situation usually can be remedied more simply although the re-routing of leads sometimes will require substantial changes.

Alteration of the manner in which the external leads are made up to a 3-phase transformer or bank can affect the phasing rather intricately. The simplest change consists of transferring the external primary connections, all in order, to the next terminal. This often is called rolling the phases. The transformer vector diagrams, both primary and secondary, move around by 120 degrees, the amount of one phase shift. Thus, they look the same as they did before, except that terminal numbers are shifted. This seldom has significant practical effect.

Another permutation consists of the interchange of two phases only, on the primary side.* Pictorially, interchanging two phases is like turning the diagram through 180 degrees about a line passing through the unchanged phase terminal and perpendicular to the line joining the two phase terminals that were interchanged. This is not a simple "pin-wheel" spin, but rather a "mirror image." Indeed, if no other change were made on the secondary, all the 3-phase motors supplied through that transformer would rotate in the opposite direction.

Figs. 5 and 6 show what would happen to the phasing relationships shown in Fig. 4 if the phase voltages connected to two of the primary terminals were interchanged — Fig. 5 for the delta primary, and Fig. 6 for the wye primary. For each, the original diagrams are shown, and below each diagram the result after the interchange. In order to show these results clearly, the terminals have been marked, the identifications being those for a three-phase transformer with low-tension side primary.

The terminals interchanged are the X1 and X3. Since the line joining them is horizontal on the page, the line about which the diagram turns is vertical on the page. The first effect to note is that all secondary diagrams turn through 180 degrees about a parallel line, that is, vertical on the page. This condition must prevail, even though some of

*In these discussions the term "primary" is used merely to identify the windings to which something is done, in order to trace its effect on the "secondary." High- or low-tension windings can play either role.

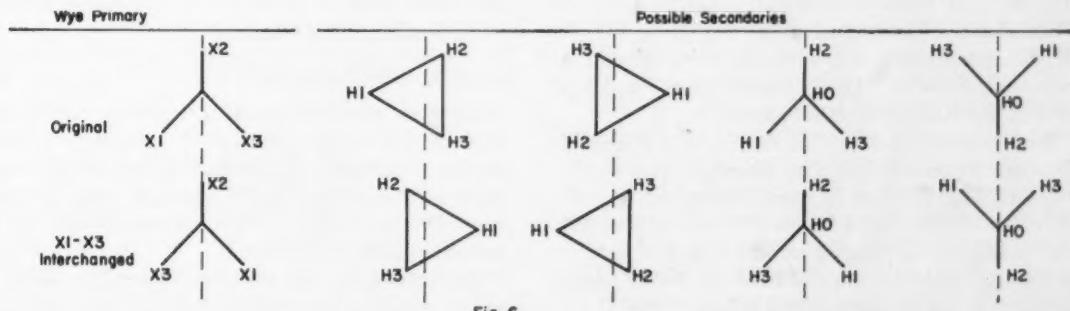


Fig. 6

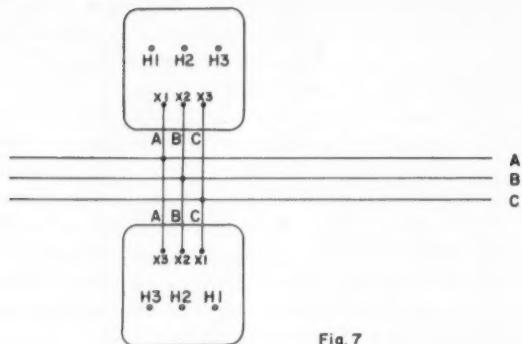


Fig. 7

the diagrams turn about a line with respect to which they (the diagrams themselves) are not symmetrical. It will be noted that these are the delta-wye and wye-delta combinations, about which we have had occasion to observe some oddities previously. This results in the familiar 60 degree phase angle shift. The over-all result will be a reversal of phase sequence, and if a delta-wye transformation is involved in any way there also will be a shift of phase angle, in the amount of 180 degrees minus 120 degrees or 60 degrees.

Another way of visualizing this situation is to assume fixed external connections, and imagine the transformer run in for connection to them from the opposite direction. With the transformer terminal connections located in the standard manner, in line on both the primary and secondary side, this produces a physical arrangement that corresponds exactly to the mirror reversal indicated by the phase diagrams. The actual physical arrangement is shown in Fig. 7.

A main bus, A-B-C, which can be assumed to be energized with the potentials A-B-C of Fig. 2, runs past a pair of identical transformers which are mounted back-to-back (or face-to-face). A cross bus is tapped off the main bus and run in each direction to the primary terminals of the two transformers. The terminals of the upper transformer connect to the cross bus like the original primary of Fig. 5 or Fig. 6 connecting to the voltages of Fig. 2. The lower transformer connects like the "interchanged" arrangements of Fig. 5 or Fig. 6. If the transformation is a simple delta-delta or a wye-wye, there will be no trouble. But if a delta-wye is involved, difficulties may arise.

The example in Fig. 7 is simple, and it should be easy to avoid difficulty. However, the conditions of Fig. 7 occur in many guises not so evident. The features of a layout which usually reveal the possibility of phasing error are such things as a common aisle for parallel rows of similar transformers, a bus layout forming a huge letter U, or

anything that contains a back-to-back or face-to-face element.

A common condition — exactly Fig. 7 except without the original main bus — consists of a transmission line with so-called duplicate terminal transformation layouts at each end. Imagine Fig. 7 with the transformers pulled apart many miles. Such a straight-away routing of a transmission line is not uncommon. Identical switchyard designs will be made for the two terminals. The mileage separation obscures their opposite-hand positioning and the fact that the line phases thus approach in reversed sequence.

On occasion it will be economical to preserve an opposite-hand layout. In this event it will be necessary to have any 3-phase transformers with delta-wye connections made up internally according to the orientation they are to assume. This will restrict the extent to which they can be used as spares to each other, and may involve extra spare capacity.

The fact that the British standard is more comprehensive in some ways than the American standard is of great significance. Recognition of the several phasing connections, with the greater familiarity it must create, should remove one source of potential error in making up system interconnections. Refusal to recognize a possible connection in a standard does not proscribe the possibility of its occurrence. Indeed, the growth history of the American power industry actually has fostered all possible combinations. Each situation must be analyzed on its own merits, and the person who wishes to make the correct transformer application frequently must deviate from the standards.

It is interesting to note that the British standard specifically states that the transformer vector diagrams are drawn for counterclockwise rotation. The American standard for transformers does not contain a similar statement, but is presumed to conform to the accepted convention for vector rotation stated in another Standard. That is section 1.8 of Standard C6.1 for Terminal Markings for Electric Apparatus. However, this section merely states that vector diagrams "should be" drawn for counterclockwise direction of advance. This seems rather weak wording for a standard.

Rotating Machinery

Phasing on projects involving rotating machinery is somewhat simpler than with transformers, but no less important. The internal design of the machine is intimately related to external design by the mutual relationship of direction of rotation and terminal phase sequence.

For generators, the direction of rotation of the prime mover is involved. Mechanical drives permit

freedom of choice, but, once chosen and built, must remain unchanged. Thus, direction of rotation must be coordinated with the sequence in which the phase leads are brought to the terminals. With the size of generators now in common use, the physical construction of the generator leads is no small item. Their routing from the generator terminals to the point of connection to other equipment must be carefully laid out and predesigned. No changes of any significance by the field crew can be permitted. The internal design of the generator is the link between the prime mover and the generator leads. It is the responsibility of the consulting design engineer to coordinate these requirements so that the generator manufacturer can build his machine correctly.

There are standards relating to these matters, but, perhaps wisely, they do not establish a rigid relationship. Section 2.1 of that ASA Standard C6.1 establishes the standard direction of rotation for most machines, except induction motors, as referred to the drive end. Section 1.6.2.1 establishes the phase sequence with respect to rotation as referred to the connection end of the coil windings for all a.c. machines, except polyphase induction motors. There is no assurance that these two bases of reference for rotation bear any specific relationship to each other. On every project the rotation and terminal phase sequence must be coordinated, independent of any standards that may exist.

With motors, the mere weight of numbers invests the matter of phasing with a great deal of importance. The basic requirement is the direction of operation of the driven machinery, as governed by the direction of rotation of the motor. In the polyphase motor, rotation is governed by the time sequence of the potentials connected to the motor leads. With individual motors there ordinarily is no great hardship involved in interchanging two connections if the rotation is found to be incorrect. But multiply this many times over for a substantial percentage of all the motors on a sizable job, and it soon becomes evident that preliminary planning can pay substantial dividends.

Here, the responsibility of the consulting design engineer is somewhat difficult to define. With relatively little effort it is possible to set up requirements and follow through in their application so that the field crew will know in advance what the direction of rotation of a motor will be for a given phase connection. Substantial savings in field costs can be realized, even on unit price or other types of bid jobs, if this is done. However, many owners have a blind spot regarding engineering efforts that save field work. The cost of each activity usually is judged by itself, without relation to other costs of the project. The common exception to this is,

of course, to blame high construction costs on poor design. There is usually no inclination to look for reasons to credit good design when construction costs are low. Also, the contractor will lose no time in blaming the engineer, if some effort has been made to take advantage of planning the phasing and motor rotation relationships, and things go wrong. Thus, the consultant often is not willing to take on this additional work.

The Standards do not provide any relief for this situation. Most of the motors involved will be polyphase induction motors. It is noteworthy that this is the one class of rotating electric machinery that is specifically excluded from the Standards.

In place of recognized standards, standardized methods in manufacture can be utilized to help plug the gap. Complete coverage in this matter would require a survey of all motor manufacturers' methods, or unification of practices under NEMA procedures. One major motor manufacturer states that if a horizontal 3-phase induction motor is connected to a source of power such that the phase sequence corresponds to the terminal sequence T1-T2-T3, the direction of rotation will be such that the top of the rotor moves toward the conduit box. All other induction motors are left undefined, but the factory could predetermine the relationship of rotation and phase sequence.

What emerges from this is a practice that has gained some acceptance and can be utilized with some degree of confidence. This requires the manufacturer to indicate somewhere on the motor the direction of rotation for a specific terminal sequence. Some years ago this was done on the fairly large motors at no charge. Engineers might do well to investigate this matter on jobs involving a large number of motors, making sure that the savings will be worth while. In a broader sense, this is a problem for NEMA.

Problems With Other Equipment

Other items of equipment which present phasing problems include the main bus layouts, major switching equipment, some of the minor switching equipment, and some of the heavy interconnections. Much of the problem here involves relative geography of the equipment, with restrictions made more severe by the fact that much of the equipment is of integrated factory assembly.

Usually, the first approach is to establish an overall sequence of phase position. This must be done for three directions, a north-to-south direction, an east-to-west direction, and a top-to-bottom direction. Generally there will be some company history that will establish this, or at least provide a guide. But the use of this phase position sequence must be tempered with reason, for it can create difficult

connections to equipment. Consider again how a phase angle shift can occur when transformers are connected to a common bus tap back-to-back or face-to-face. The angular shift can be avoided and still permit the use of identical transformers if the bus taps can be taken off to one of the transformers in reverse geographical sequence. Another solution is to reverse the orientation of one transformer, but the location of the secondary leads and control and auxiliary leads then must be revised accordingly. It is important that this be planned in advance. If it is not, a control duct run may come up on the wrong side, the main power leads may not match up, or some similar difficulty may occur.

With other equipment the problems are much the same. Having established a phase relationship for the approaching leads, the designer must be prepared to follow it through the gear. Sometimes this calls for internal connections which differ from the manufacturer's usual practice. The back-to-back arrangement may result in nonduplicate unit assemblies. Sometimes a plant layout is completely planned when something happens to require that some of the gear be turned about. This may affect the geographical phase orientation with rather annoying consequences. A good way to avoid such difficulties is to stop geographical phase orientation short of the minor gear that is apt to get kicked around, and use a phase sequence related only to the front of the gear. Of course, the client's rules and regulations must be observed.

Pertinent Equipment Data

The manufacturers' data on certain kinds of equipment provide information that is necessary for control of its phasing. The form and subject matter vary with the kind of equipment and the practices of the particular industry.

Generator manufacturers usually will produce a drawing called the Electrical Outline. On this drawing the terminals will be marked in accordance with industry standards. The locations of the terminals will be shown in plan and section, and the plan even may be a "reflected" view. Also, there will be a small rotation diagram, representing the physical direction of the field, or rotor, with a statement of the time sequence in which the terminals attain a positive maximum with the indicated field rotation. The user must be careful to recognize this diagram for what it is — field rotation, not phase rotation. It sometimes is drawn so that it looks like the latter.

For transformers there are two sources of data, one being the outline drawing and the other the nameplate drawing. The outline drawing will give the terminal markings in accordance with industry standards, and the location in plan and section. The

nameplate will give the winding vector diagram for 3-phase and other multiphase transformers. For single-phase transformers it will state whether the polarity is subtractive or additive.

Motor drawings usually will not contain any information on phasing. However, if the terminal phase sequence and direction of rotation have been coordinated, the manufacturer will, upon request, include the pertinent information in an endorsement on the back of the prints, along with the certification and other special data.

For switchgear in general, the main requisite is to be able to trace the phases through the gear and be able to identify the terminals correctly by phase. There are no established procedures among the manufacturers. Clarity of draftsmanship is important, but if there is any doubt the manufacturer should be required to identify the leads.

Design Controls

Getting the information provided by the equipment manufacturer is only one stage in the process of establishing the integrated phasing of a plant. The plant design and construction drawings complement this by prescribing the mutual phasing relationships of the equipment, and how it assembles.

The over-all phasing should be shown in juxtaposition to the circuit involved. Sometimes this is

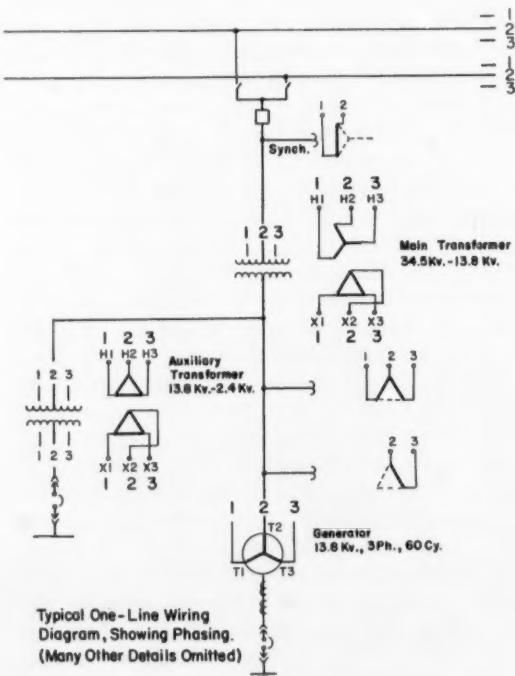


Fig. 8

done by means of a separate drawing called a "Phasing Diagram." When the circuit is not too elaborate, it is convenient simply to add the phasing to the main one-line wiring diagram. Fig. 8 shows how this can be done for a typical generator and transformer unit combination, with unit auxiliary transformer. This must be amplified by means of a note which tells the reader just what is being done. This note may vary due to the circumstances of the individual case, but the following is typical: ¶Vectors represent time sequence and relative time positions based on counterclockwise rotation of vectors. All vectors shown for same instant. System phases are identified as 1, 2 & 3.

Note that for each item of equipment with which voltage is associated there is a related group of vectors, including even potential transformers. This is useful in wiring up the controls correctly for metering, relaying, and synchronizing. Some degree of geographical relationship can be indicated, although it is not wise to make a one-line diagram a geographical layout unless significant and feasible. Thus, the three individual phases have been indicated in plan view for the switchyard main buses and at certain points in the generator-transformer circuit. Their position is important with respect to direction of approach to transformer and generator.

Some of the vector groups shown on the phasing diagram may not correspond exactly with what the manufacturers' information shows. A slight angular shift may be necessary in order to time out with existing records. Or, the difference may be the result of a change in phase sequence. Particular care must be taken in all such instances, especially in dealing with plants combining American and foreign equipment. For instance, American and British practices are consistent within themselves, but are opposite hand to each other. Thus, with American equipment, the generator terminals are T_1 , T_2 , and T_3 right to left, the transformer low-tension terminals X_1 , X_2 , and X_3 left to right, and the transformer high-tension terminals H_1 , H_2 , and H_3 right to left. When all three are shown "stretched out" in line as in Fig. 8, they produce a uniform geographical sequence 1-2-3. The British arrangement would be generator terminals A, B, and C left to right, transformer low-tension terminals a, b, and c right to left, and transformer high-tension terminals A, B, and C left to right, yielding a geographical sequence A-B-C that is the opposite hand to the American 1-2-3.

In addition to the phasing shown on the diagram, certain physical layout drawings should be phase identified. On the main bus layouts the phases should be marked on the main buses and as many of the taps as seems necessary, in accordance with the geographical sequence used. The phase identifi-

cations, as well as the manufacturers' terminal identifications, should be shown at generators and at high- and low-tension transformer connections. Frequently, due to either physical size or voltage clearances, the intervening leads must be run in a manner which allows very limited freedom, and the phases must be carefully routed all the way.

This usually will tell the complete story for field work, but it frequently involves gaps which must be filled in by back-up design notes. In other words, it provides the result, but does not contain the proof within itself. It is a good idea to develop a study sheet for each major item of equipment. On this study sheet should be entered all source data with identification of the source, including manufacturer's print numbers and company file identification, a thumbnail sketch of the equipment establishing the orientation and location of terminals, and the result showing the terminal phase identification.

For a generator, there would be a reference to the electrical outline drawing and a little sketch showing the generator oriented geographically or by building lines, or both, with the terminals located and identified. The start of the leads should be shown, with their system phase identification. The direction of rotation and the terminal time sequence for that direction, as stated on the electrical outline, also should be recorded.

For a transformer, reference to the outline drawing and the nameplate should be made, and a sketch included showing the transformer properly oriented, with the location and identification of the high- and low-tension windings and any tertiary winding. The method of approach of the main leads also should be shown, with their system phase identification. For a 3-phase transformer the winding phase diagram as it appears on the nameplate drawing should be shown. For three, single-phase transformers the polarity should be stated, and the thumbnail sketch should cover all three units.

Such a study sheet contains the basic equipment information and the pertinent installation facts. The vector diagram for a particular system phasing can always be established or checked from it. In fact, it may be advisable to show the vector group as it should appear on the final design drawing for each item.

Ordinarily it is not necessary to make study sheets for other classes of equipment. Usually their connections are self-evident or worked out on the layout drawings. Generators are considered here as representative of rotating machinery as a class. Frequency changers, synchronous condensers, and even motors would receive similar treatment when of a size that would make the running of the leads a problem.

For the Architect ...

the Contractor ...

the Consulting Engineer ...



The Three Facets of Free Engineering

J. DONALD KROEKER

J. Donald Kroeker and Associates

THE TERM *free engineering* does not convey a uniform concept. It is even contended that there is no such thing as free engineering, since all engineering is paid for by someone in some manner—although amounts paid and manner of compensation may not be disclosed. Those who claim there is no such thing as free engineering enclose "free" in quotation marks to show that the term is used with other than the accepted meaning. This compounds the ambiguity.

At its meeting in Cincinnati, in November 1959, the Board of Directors of the Consulting Engineers Council approved a policy statement that purports to define free engineering. It does seem to come fairly close.

Free engineering, as it refers to the construction industry, is the practice of concealing charges for providing professional engineering services in connection with furnishing materials, equipment, or labor of construction.

But even this definition is faulty, for it states that free engineering is the practice of *concealing charges*, which might be termed *doctoring* but hardly *engineering*. Since, how-

CE exclusive

ever, the definition is close, it is not too difficult a matter to restate it properly.

Free engineering, as it refers to the construction industry, is the practice of providing professional engineering services in connection with furnishing materials, equipment, or labor of construction and of concealing charges for such professional engineering services.

No one should claim there is no free engineering according to this definition. Further, the statement is sufficiently inclusive to comprehend several types of free engineering. Yet, the definition still is not sufficiently detailed to adequately communicate all the concepts and problems involved.

Basically, free engineering is provided by a manufacturer or a manufacturer's representative to adapt his materials or equipment to a construction project. From a manufacturer's viewpoint, it is used to develop greater sales of his product. It has been applied in all branches of engineering. It has included the design of pumping and supply systems in waterworks projects; turbine generators in power plants; electrical layouts; structures; and heating, ventilating, and air conditioning systems — just to name a few.

At one time this provision of engineering services by manufacturers was necessary, since consulting engineers were not everywhere available in specialized fields of practice. For example, as little as 10 years ago, there was no mechanical engineer in a city which ranked among the first 20 in population in the nation. There are still some specialties and some locations in which there are no consulting engineers competent to provide the design necessary. Except in these fields, and in these locations, the manufacturers and their representatives now generally confine their engineering activities to providing product information.

Types of Free Engineering

Free engineering can be classified according to the recipients of the services. These would include:

1. An architect or some other professional man not a consulting engineer.
2. A contractor or an owner.
3. A consulting engineer.

For Architects

The greatest hue and cry on free engineering has related to Type 1 — chiefly engineering services offered to and performed for architects. In this type, a representative for boilers, pumps, radiators, fans, or other items of equipment provides complete design drawings and specifications without charging an engineering fee. Naturally, specifications call for equipment the designer represents, often to the ex-

clusion of other equipment which might have done the work better. Further, the salesman's design is usually less complete where it deals with equipment he does not represent. This is only natural, for if he represents heating and air conditioning equipment, he has not likely to have become competent in design of plumbing, refrigeration, or automatic controls, ad infinitum.

The transition from this type of free engineering by manufacturers' representatives to design by engineers in private practice is nearly complete in this country. A region in which transition had not been made and which came under attack last year was centered around Salt Lake City. Consulting engineers in other areas attempted to help their colleagues in Salt Lake City "clean up the situation" by writing to the local firms providing free engineering or to the manufacturers they represented. These letters ranged from excellent explanations of the undesirable aspects of the practice, to statements that so long as the representatives continued to offer this type of service, the writer would consider them in direct competition. Generally, it seemed that letters to the manufacturers, who responded to all correspondence (albeit some with probably uncalled-for vehemence aimed at their agents), were more effective than threats directly to the representatives.

There always will be architects who will accept — even request — this type of free engineering. But the number of architects who do will be relatively small — usually confined to those with limited practices. Here complete eradication of free engineering will depend on the efforts of manufacturers and their representatives.

For Contractors and Owners

Free engineering of the second type, that offered to contractors or owners, is a big and separate subject. It always will be with us in some form. It can involve a heating plant in a two-bedroom house, or an air conditioning system for a multi-story building; a house lighting layout, or an electrical distribution system for an industrial plant. Frequently, it amounts to an engineer in a manufacturer's representative's office assisting a contractor with design in order to sell an installation to an owner. In municipal and larger public work, it is vanishing. With private owners, its reduction will come only through proper public relations and educational programs conducted by consulting engineers, state consulting engineer associations, and the Consulting Engineers Council.

For Consulting Engineers

Most disturbing is free engineering of the kind designated as Type 3. This is free engineering pro-

THE CONSULTING ENGINEER'S CREED

As a Consulting Engineer

I BELIEVE . . .

That the profession of engineering is not a mere art or craft — for me, it is my way of life;
That I am in debt to the world for the respect and confidence accorded engineers;
That sound engineering judgment cannot exist in a dishonest mind.

I OWE . . .

To all men: A useful life, doing to everyone as I would have them do to me;
To my profession: Full competence in all work that I undertake, just treatment of my professional associates, and adequate contribution to the advancement of engineering;
To my client: An honest and finished job, the best I can do, always in the spirit of our agreement, regardless of compensation;
To myself: My self-respect and a clear conscience.

THE WORLD OWES ME . . .

Only what I earn.

vided to consulting engineers. Little has been said about it, yet it is undermining the integrity of the consulting engineer and the position he occupies as an informed, impartial, fair professional man. While it is doing the most to undermine his standing and weaken his clients' confidence in him, it is also the type of free engineering that the consulting engineer himself can stamp out.

A couple of years ago, the annual meeting of the Professional Engineers of Oregon included a symposium on free engineering. Many examples of design assistance required of the manufacturer's representative were discussed. The moderator aptly summarized the symposium with the statement, "As I understand it, free engineering is a horrible practice which should not be countenanced — except when it is offered to consulting engineers."

This statement gave the audience a jolting shock. Each recollection of it brings on a twinge that pricks at the pride and satisfaction one has in being a consulting engineer.

In several major cities of the country, it is accepted practice for a mechanical consulting engineer to design a heating, ventilating, or air conditioning system and then call in a temperature control firm to provide drawings and specifications for the temperature control system. In some instances, the manufacturer actually draws his layouts on the consulting engineer's sheets. On larger jobs the manufacturer is given clean, new tracing sheets to facilitate his work. The only way the temperature control firms can stay in business in these cities is to provide this service. For sales representatives to condition the consulting engineer so that he is ready for an offer of assistance of this type ultimately leads to practices that are acknowledged to be reprehensible.

It is characteristic of the temperature control field that no two firms perform the same function with the same instruments or by the same methods. Accordingly, when one firm does the design work, competition is stifled, or alternate designs must be

offered during construction — and they then must be evaluated on the basis of a competitor's design. In the meantime, the consulting engineer has accepted fees for work he has not designed personally and has represented himself as competent in a field for which he has not adequately prepared himself. This involves a degradation of morality and integrity.

Another example is provided in the design of pumping systems in water works projects or in hydraulic systems. The manufacturer's representative is called in to provide complete equipment selections and specifications, and to furnish engineering analyses of heads, pipe sizes, accessories, and appurtenances. Naturally, he will design and specify around his product, to the subtle exclusion of others. The result is that the consulting engineer has prostituted his obligation to the client and to his code of ethics. He accepts a fee he has not earned. He is labeled as being incapable in a field in which he has represented himself as a specialist.

Selection of air distribution devices by a manufacturer's representative is another common means of providing free engineering to the consulting engineer. In some cities it is common practice to call in representatives of room air distribution devices to analyze requirements and to make selections of equipment. Possibly the consulting engineer has failed to educate himself on air distribution problems; does not know how to design properly for them; and is unable to evaluate changed conditions in the project later. Possibly he is merely reducing his costs. In any event, he has not assumed the obligation he accepted.

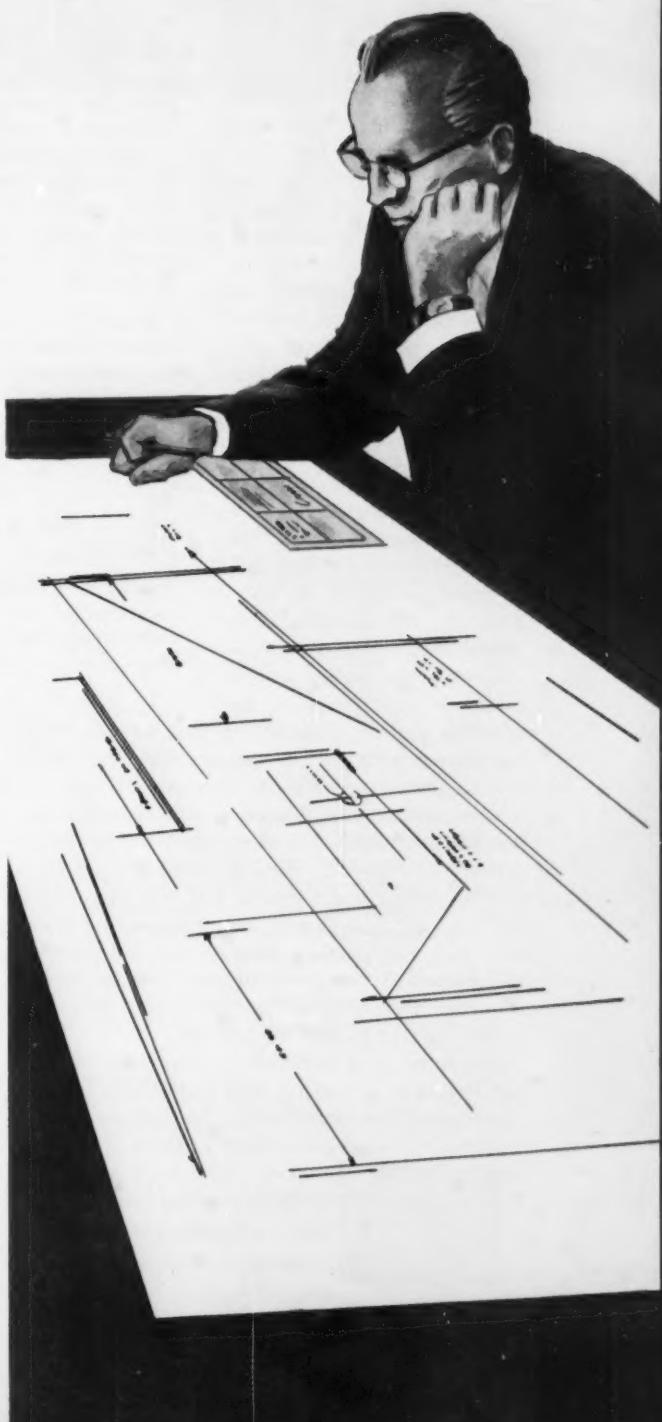
In heavy equipment specification, such as water-tube or high-pressure boiler plants and turbine generator equipment, inexperienced consulting engineers often call in representatives to provide complete design and specification materials rather than engage another consultant who is a specialist in the field. These designs and specifications then are incorporated in his work.

Many more examples might be given, not only in mechanical, but in electrical, civil, and structural engineering. A detailed list would be nearly endless.

Initial Policy Is Important

One also can find, all too often, free engineering being provided to the engineer who has newly opened a consulting office. He may have worked in another engineer's office, where he may have observed the entire gamut of design, specification work, and construction supervision, but he may have specialized and knows in detail only one field of design. Suddenly, he finds himself called upon to handle many other phases of a project. He does not have the time to become expert in these re-

About all some consulting engineers can claim in a drawing is the title block.



lated fields. To save time and money, he calls in a manufacturer's representative to design a portion of the job for him.

It works. He does it again and again until it becomes a regular procedure. He has not stopped to think what this does to his integrity, the effect it will have on his client when the truth is known, or the laughter and scorn of the contractors who read his specifications and work from his drawings. He is talked about, yes, but not in the way that will build his stature or his list of clients. He does not stop to think what it does to his colleagues. By his own actions, he has prostituted his contractual obligations. This is professional immorality.

If a consulting engineer has regularly accepted free engineering, it is generally because he has not informed himself sufficiently in certain technical fields or he has not employed other consultants who are fully versed in these fields to assist him.

However, there is a place for engineering information and drawings provided by suppliers. Even though the consulting engineer does not accept free engineering, he must rely on the supplier for product engineering data and, in many instances, for shop drawings. For example, if, in temperature or automatic control work, he writes a performance specification, he must have shop drawings so that he can check compliance with the performance specified. Again, it is frequently necessary to have conferences with a representative to discuss equipment available, details of application, and economics of a specific system. This product data is needed in all engineering design, and it can be had only from manufacturers, for it deals with their products for which only they can promise performance. To listen to the salesman's story and understand his product is part of the consulting engineer's job. This is in no way related to free engineering.

The trend, it is believed, is away from consulting engineers accepting free engineering. Again, as in other free engineering, the practice springs from the manufacturer's efforts or those of his sales representatives to promote the sale of a product. The representative offers to help the consulting en-

gineer, who falls into the trap through avarice, failure to apply his code of ethics, stopping his ears to the voice of his conscience, blindness to the danger of undermined client confidence, or refusal to see that he is hurting the integrity of his profession.

While the trend is away from the practice, there have been recent reversing influences. The proposal a few years ago for use of the base bid specification is one vicious factor. While, on the face of it,

the base bid specification has some advantages, it encourages free engineering to consulting engineers. It develops reliance on limited selection, which, in turn, ultimately leads toward free engineering. It is a camouflaged trap.

The Solution

Is there a solution to this insidious practice of the consulting engineer accepting free engineering? Indeed, the solution can be simple, for the consulting engineer himself has complete control if he will but exercise it. He need only answer a few simple questions. He might ask himself:

¶ Do I want to be able to live with my conscience?

¶ If I do not have integrity, have I anything?

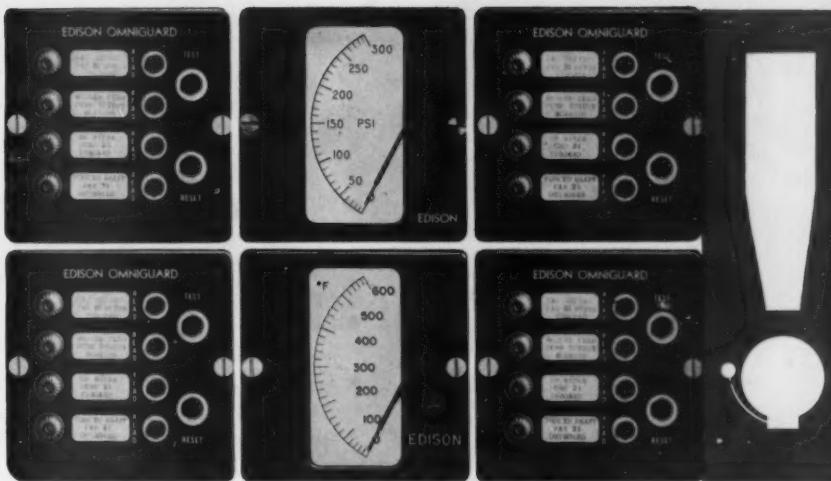
¶ If I do not care about myself, do I not owe my contemporaries and the profession a few debts?

¶ Am I really competent, and if not, how can I become competent in all phases of my work?

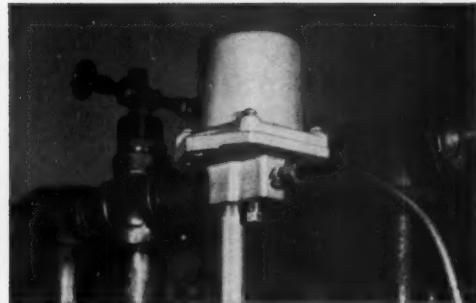
Available for further guidance is an excellent check list. The Consulting Engineers Association of California has developed a creed for consulting engineers, subsequently adopted by the Consulting Engineers Council. It is reprinted on page 102. Consulting engineers who accept free engineering should read and absorb this, line by line, and adopt it as their own personal creed. If this is done, acceptance of free engineering by consulting engineers will soon be unknown.

Finally, there is the full statement of policy with respect to free engineering adopted by the Consulting Engineers Council. It should be understood to work both ways. It warrants the attention of consulting engineers as well as manufacturers and their sales representatives. □□

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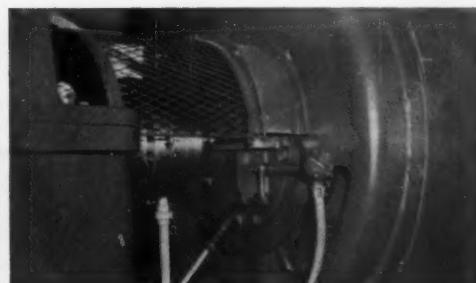


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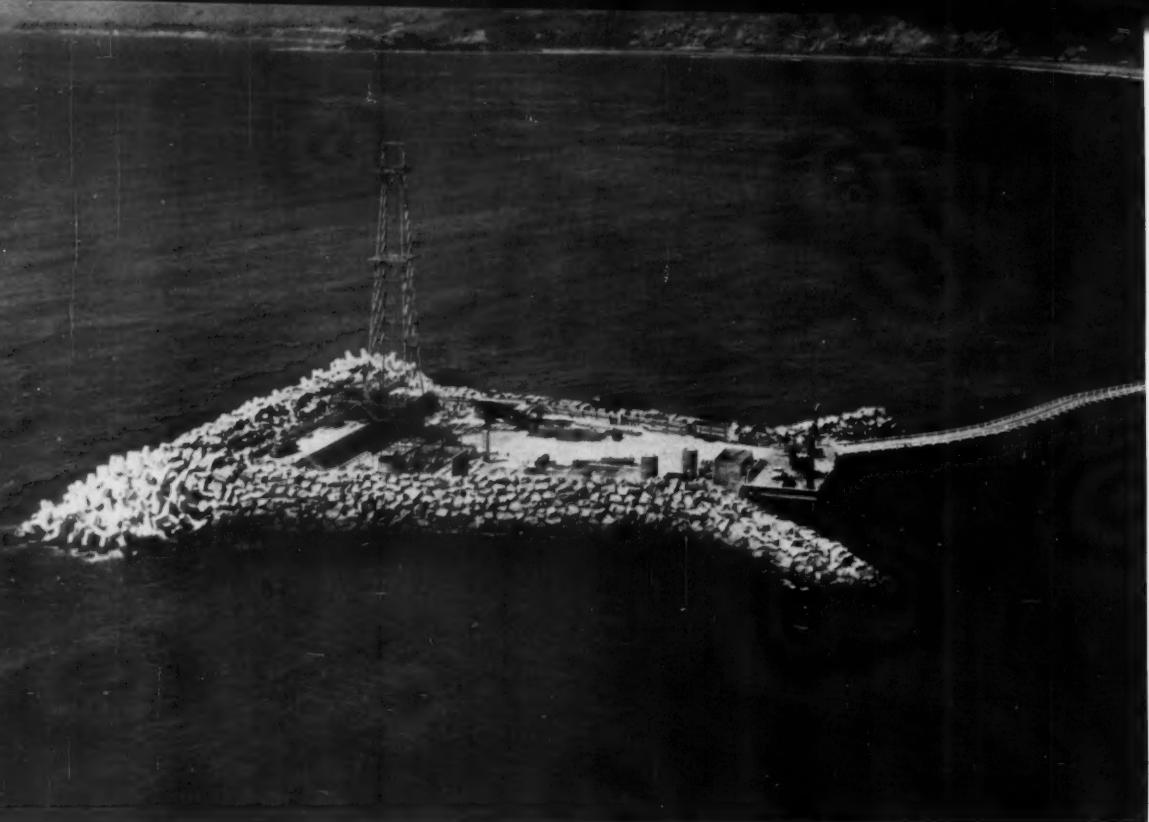
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Rincon Island is an artificial island off the California Coast, built for the Richfield Oil Corporation.

Plant Sites in the Sea . . . Offshore Structures and Islands

ROBERT E. HOLLICK, Structural Engineer
International Engineering Company, Inc.

AN EARLY AND NOTABLE example of offshore construction is the Eddystone Lighthouse in the English Channel, 14 miles off Plymouth. It was built in 1757 by John Smeaton of substantial granite masonry on a submerged rock foundation. This lighthouse was preceded by two wooden structures, one lost by fire and the other by storm. It was made of massive interlocking masonry units reinforced with vertical and horizontal iron bars. This fine example of offshore construction led the way to other successful structures of the same type founded on rock. Minots Ledge Lighthouse, off

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Boston harbor, is of similar design and has proved itself over many years and under heavy seas.

Lighthouses on sandy or muddy bottoms were first constructed on an open framework of braced piles. These structures were originally of wood, but when wrought iron was introduced it brought them a greater degree of permanence. Several such structures are still in service.

Today, a new chapter in the history of offshore structures is being written. The petroleum industry, in its never ending search for additional oil fields, is pushing offshore. The first venture in recent offshore structures for petroleum was in 1947,

on the continental shelf along the Gulf Coast of the United States.

The Continental Shelf

The continental shelf is, by definition, the land mass lying submerged in less than 600 feet of water. At about this depth the shelf breaks off into the steeper continental slope marking the true edge of each continent. About one-twelfth of the ocean area of the world is underlain with continental shelves. The continental shelves of the U.S. cover some 750,000 square miles (about 6.4% of the world's total), of which 129,000 square miles lies in the Gulf of Mexico. This strip averages 70 miles in width, with a maximum width of 175 miles. Adjacent to the

continental shelf from the Mississippi to Mexico there is an area of some 60,000 square miles containing 1300 known oil and gas fields.

The first push toward the open Gulf was into the marshes, swamps, and shallow water of bays and lakes inshore along the coast. This operation began about 1926, and was furthered by the development of both modern geophysical prospecting methods and drilling procedures, and equipment adaptable to marsh and swamp locations. No single type of structure has proved satisfactory for the various sites. Earthen islands, wood-matting frequently surrounded by flood protection dikes, and pile structures were developed in various forms during initial development in the marsh and swamp areas. A later and significant development has been the submersible drilling barge. On such a rig, the main deck and all the drilling equipment is high enough to clear storm tides when the barge is resting submerged in shallow waters. The barge is slotted for drilling and after well completion can be removed, leaving a small pile supported platform to support the well head of the producing wells. This type of operation, although not offshore, introduced the petroleum industry to the difficulties and additional expense of marine work and was the direct antecedent of true offshore work. True offshore oil drilling, quite naturally therefore, began along the Louisiana and Texas coasts approximately 13 years ago.

California's Offshore Development

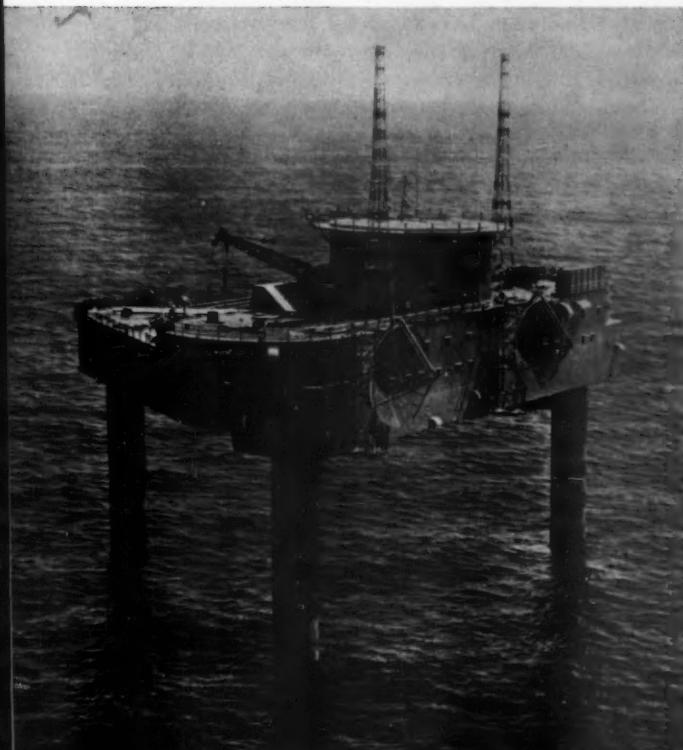
The southern California coastal area extending from Point San Luis south through Los Angeles to Huntington Beach is dotted with known oil fields. Again, as in the Gulf of Mexico, the drilling and production of oil was first carried up to the waters' edge. Here the offshore development in California was delayed longer than in other areas because state law permitted only the construction of artificial islands of natural materials. Directional drilling from such island or shore locations served to tap a limited offshore area. A State Act of 1955, permitting fabricated offshore structures, now allows for further development of the California coast.

The California coastal area differs greatly from the Gulf of Mexico. The ocean floor slopes comparatively rapidly and reaches depths of 300 to 600 feet about three miles offshore. Also of importance is the relatively hard bottom material, with rock outcrops, generally overlain with sand, and with very little mud. Other factors are a continuous ocean swell, tidal currents, possible earthquake hazards, and occasionally very large waves.

For exploratory drilling, in order to overcome the limitations of working from artificial islands and shore line extensions, a Gulf coast mobile drill



Texas Tower No. 4 was towed to its site in two sections. Above, the tripod base is shown enroute. In the lower view, the platform has been elevated to its final position.



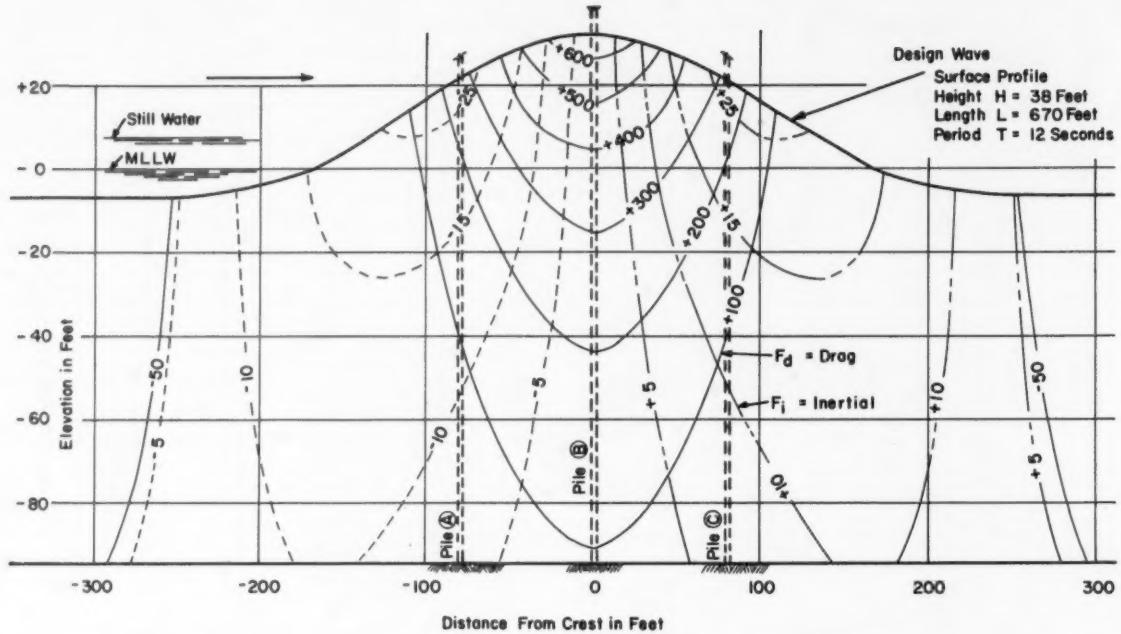


Fig. 1. Oscillatory waves produce both drag and inertial forces on submerged structures such as piles.

barge was brought to the West Coast and put into operation in 1957. This first offshore unit operating along the California coast is a De Long floating barge of the multiple-leg, jack-up type with a deck area of 100 x 200 feet and hull depth of 13 feet. It is suitable for use in water up to 90-ft deep.

The first permanent offshore oil platform along the California coast was installed in 1959 for the Standard Oil Company of California. Known as Summerland #1, this drilling and production platform is founded on solid shale in about 100 feet of water. It provides for the drilling of 25 wells. Summerland #2 will be floated this year and set in 106 feet of water, with caisson supports set through a 50-ft thick overburden to the top of the shale. This platform will provide for the drilling of 24 wells. Other platforms are expected soon.

Exploration and exploitation of the 11,800,000 square miles of the world's continental shelf has only begun. There are still tremendous unexplored areas. In addition to U. S. offshore oil operations, Russia has a major oil producing field in the Caspian Sea, the Persian Gulf is under active development, and Europe has its first offshore oil well about 1½ miles off the coast of Sicily. In this hemisphere the Lake Maracaibo development in Venezuela has been operating for years, and there are oil strikes in the Gulf of Campeche offshore of Mexico as well as three miles offshore of Peru. Meanwhile, the Gulf of Paria between Trinidad B. W. I. and

Venezuela is being explored, as are the coastal waters of the islands of Japan.

Other Uses for Offshore Structures

The U. S. Air Force was one of the first groups to take advantage of the research and construction experience of the petroleum industry. Permanent platforms were installed off the Atlantic Coast for mounting early warning radar equipment. The shallow water of the continental shelf on the Eastern seaboard made such structures possible. Three were built between 1955 and 1957. They were set as far as 100 miles off the Coast in water depths of 56, 82, and 185 feet.

These radar platforms are known as Texas Towers because they undoubtedly were inspired by the successful use of drilling platforms in the Gulf of Mexico. Although similar in many respects to these oil drilling platforms, it should be pointed out that the radar platform is not subject to the lateral load of waves on well conductor pipes extending from the platform to the ocean floor. With many wells drilled from one platform, over 50 percent of the lateral load can be derived from the wave action on the conductor pipe. This may account for the fact that no well drilling platform has as yet been set in a water depth equaling the 185-ft record of one of the radar warning platforms.

In addition to the use of offshore structures for lighthouses, radar platforms, and oil drilling and

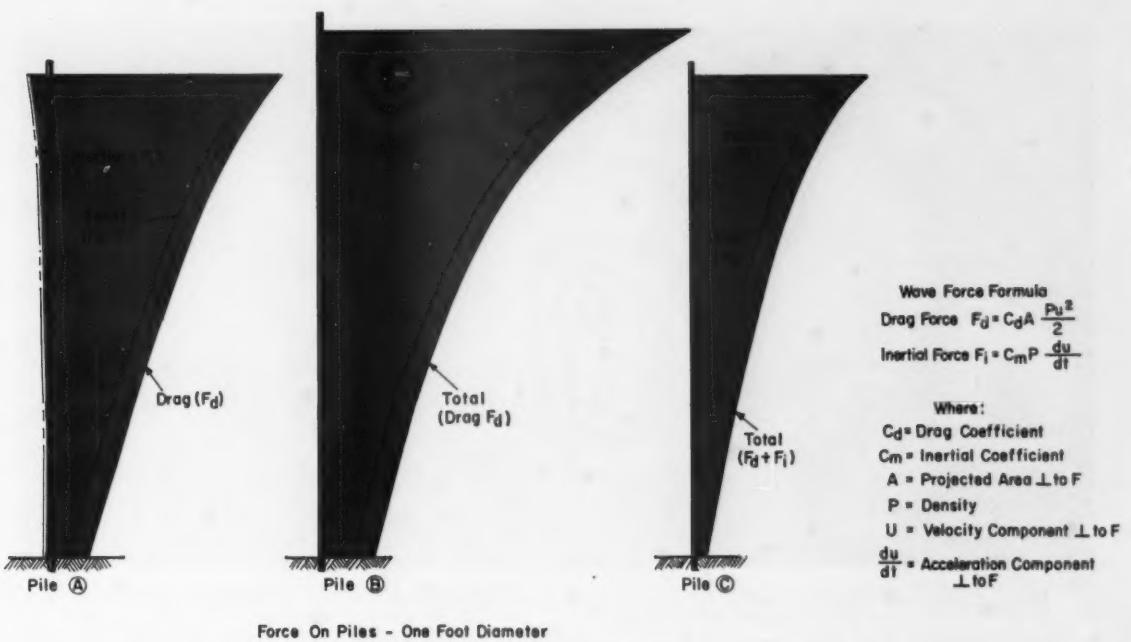


Fig. 1. Graphical representation of the wave forces occurring on a 1-ft diameter cylindrical shaped pile.

production platforms, they have been used for under water mining. The Grand Isle sulphur deposit off the coast of Louisiana is now being developed for mining from offshore platforms. An investment of \$30 million is being put into a Y-shaped group of connected platforms from which 108 wells will eventually be drilled.

Mobile offshore platforms also are being used for construction work. They have been found very useful in constructing sewer outfalls and laying ocean bottom pipelines. The best example of this is the George F. Ferris platform now being used in the construction of the Hyperion outfall sewer for the City of Los Angeles. Mobile platforms placed end to end also serve as wharves, and are particularly suitable where it is desired to do the least amount of on-site construction work.

Design Considerations

The design of offshore structures presents two problems not common to other structures. One involves the construction as a marine operation and the other involves the resistance of the structure to waves and tidal currents. The difficulties involved in marine construction, and attempts to reduce these to a minimum, accounts in part for the great variety of structures and construction methods used and proposed for current offshore projects.

Gravitational loads, and even the lateral loads imposed by wind and earthquake, are well under-

stood. Various codes control the way structures are to be built to resist these loads. The naval architect is familiar with the design of marine vessels which, as floating objects, are safe in the heaviest of seas. The codes and rules that govern the work of the structural designer and naval architect have a long history of development based on trial and error, theory, and practice. They assure safe structures. It might be supposed that a combination of the talents of the structural designer and the naval architect would result in a safe offshore structure. However, an important consideration to remember is that offshore structures, which are firmly set in place, are subject to more intense wave forces than ships at sea.

Designers of offshore structures have sought the services of oceanographers, meteorologists, and hydraulic engineers. Their combined efforts have produced some theories, plus considerable data that presently are used to make rational estimates of wave size, force, and frequency. These theories and data are not yet completely adequate, and there is likely to be considerable disparity between recommendations from different investigators.

Waves and Wave Loads

Prediction of wave conditions at a specific site is quite complicated. However, some practical methods have been developed for estimating the height and period of waves in relatively shallow waters;



Use of floating auxiliary by Humble Oil & Refining Co. cuts cost by reducing size of permanent installation.

also the height of storm tides, the crest elevation of any wave, and the wave profile of the maximum waves. The range of directions from which the maximum wave may be expected also must be determined. Oscillatory waves produce forces on submerged structures of two types: a drag force, resulting from the orbital velocity; and an inertial force, resulting from the orbital acceleration. An example of these forces and their distribution throughout a wave mass is shown in Fig. 1. Also shown are the wave forces that would occur on a 1-ft diameter cylindrical pile at various positions in the wave.

Offshore Structures in Use

A review of the various offshore structures built during the last decade reveals no simple system for their classification. Offshore structures might be listed as either permanent or mobile. Or, all structures might be listed as open framed bases or solid bases, depending on whether the waves are allowed to pass through or around the structure. However, for purposes of discussion offshore structures can be arbitrarily grouped as artificial islands, pile supported platforms, barge-type structures, and floating tower structures. The last three types of structures have been the most common in recent years, and are all open frame types.

Artificial Islands

All offshore structures that have solid bases, as opposed to open base structures, can be classified as artificial islands. Such structures, whether con-

structed as single caissons, like bridge piers, or as artificial islands of natural material, must withstand the full force of the waves on their large exposed faces. Many of the early attempts to build offshore used such island construction as a natural development in extending the shore line by land filling operations. This type of land fill, however, proves very expensive, particularly in circumstances where rock for riprap is not available within reasonable proximity of the site.

Rincon Island, located off the California coast, is an outstanding example of an artificial island. This type of construction was used to conform to California court rulings existing at the time the project was undertaken in 1954. The island is in 42 to 48 feet of water, about a half mile from shore. It is made of rock revetments filled with sand, protected by proper filter blankets. The face toward the open ocean also is protected by over a thousand 31-ton tetrapods reaching 41 feet above mean low water datum. The island has a level top area of 1.1 acre at el. +16, but its base covers more than six acres of the ocean bottom. This island is connected to the shore with a trestle causeway to eliminate the extra cost of servicing the facilities as a marine operation.

Pile Supported Platforms

Platforms that are supported on individually driven piles are classed as pile supported, to the exclusion of those supported on caissons of greater sectional area. These platforms are suitable for permanent structures but not for mobile drill rigs. Piles have

been of wood, steel, or concrete, with steel piles generally of pipe or H-sections.

An example of this type of construction, built in 1947 during the first push offshore in the Gulf of Mexico, is the Humble Oil Company's platform. It is located in water 45-ft deep, some six miles off of Grand Isle. It is a self contained installation mounting all drilling and production equipment, and includes personnel accommodations. Its two decks, 34 and 48 feet above mean Gulf level, have a gross area of 40,000 square feet. The platform is supported on 100, 10-in. H-section piles having penetrations up to 197 feet. These piles were driven in groups of four through templets consisting of four, 16-in. pipe casings braced with 6-in. and 8-in. pipe as web members. Additional bracing, installed after driving the piles, provided a completely braced support system upon which the platform was assembled. Floating derrick barges and work boats were used for pile driving and erection.

Handled as a marine operation, this type of construction is a great deal more expensive than similar work ashore, because of the additional equipment required and the reduced effective working time and efficiency of both men and equipment due to transportation and weather conditions.

One method used to cut costs was to reduce the size of the permanently installed structures to a minimum by providing all equipment and personnel accommodations needed for a limited time only on barges or other vessels. Not much more than the drilling derrick is placed on such platforms. The floating auxiliary on one project was a war

surplus LST vessel, completely reconditioned specifically for this type of operation.

Barge-Type Structures

The cost of offshore structures has been much reduced by the introduction of barge-type structures that are shore fabricated, towed to the site, and erected with a minimum amount of equipment and personnel working at sea. The barge-type structure may be made completely salvageable and is therefore economical for any offshore work such as intakes, outfall lines, and exploratory drilling requiring more stability than is provided by a floating vessel. A typical mobile drill rig consists of a barge which can drop caisson legs to the ocean bottom and then raise itself high enough to clear the wave action. Barges may be 100 x 200 x 12 feet and weigh 1500 tons. The caisson legs may be 5, 8, 10, or more feet in diameter and are generally cylindrical steel shells. A jacking system, working on each caisson leg between two caisson clamps, provides the means for raising the barge. Framed legs and other jacking systems also have been used successfully on other projects.

Texas Tower No. 3 is an example of a barge-type structure on caisson legs for permanent use. It is located in 82 feet of water, 65 miles southeast of Nantucket Island. It was the second offshore radar station built by the United States Navy for the U.S. Air Force. It consists of a triangular platform weighing some 3600 tons supported on three, 14-ft diameter caissons of 1½-in. steel plate. The legs penetrate 60 feet into the sand of the ocean floor.

This tower was towed to the site as a single unit with the platform serving as a barge and with all caisson legs raised. Eight temporary caissons, 8 feet in diameter, set in outboard brackets, were employed for raising and supporting the platform while the permanent legs were lowered, sunk to proper depth in the sand, and the load transferred to them. Temporary brackets and caissons then were removed.

The hydraulic jacking system used to elevate the platform consisted of steel cables, suspended from the top of the temporary caissons, up which climbed a system of hydraulic jacks, each working between a pair of cable grippers. The top gripper was connected to the barge through the jack that provided the movement; the bottom gripper was fastened directly to the platform and served as a dog to hold the load when the jack was moving under no load to reach for another bite.

Floating Tower Structures

There are numerous floating tower structures of greatly different designs. In general, they all have a framed support structure that is floated into place



Pile supported structure built for Humble Oil is completely self contained, including personnel housing.

and set on the bottom, with a platform supported well above the top of the waves.

The submersible drilling barge used in oil developments in shallow inland waters was the forerunner of the offshore floating tower. The platform was mounted on a tower frame well above a barge. The complete unit was towed to the site and barge unit sunk to the bottom while the drill platform remained above the water surface. In shallow waters the sunken barge, acting as a base, is subject to wave forces, and shifting or undermining from scour may result. Installation of such a tower in deeper water presents the problem of maintaining an upright condition during the barge-sinking operation as the tower structure between the barge and the platform provides practically no stability. Auxiliary floats, barges, or derricks may be required to control this operation. The drill rig Mr. Arthur is an example of a single upright floating unit designed for use in water up to 70-ft deep.

Towers used in deeper water generally are floated horizontally and then uprighted at the site. Texas Tower No. 4 is such a structure. It is the third, and last to date, of radar warning stations installed off of the northeast coast for the U.S. Air Force. It is triangular in shape and supported on three leg caissons, similar to the first two Texas Towers. Being located in the deepest water — 185 feet — of any offshore structure built to date, leg bracing was required.

This tower was towed to the site as two separate units. The tripod base was constructed and towed to the site in a horizontal position. It consisted of the three, 12½-ft diameter caissons, 288-ft long, spaced 155 feet apart, and laced together with 2-ft diameter permanent web members to form a single unit. Two of the caissons served as floats, while the third rode high above the water surface. This tripod was up-ended at the site by manipulating the buoyancy, and the bell bottom bases were lowered some 20 feet into the sand bottom, using an air lift.

The platform was built complete as a separate unit with pockets and brackets for engaging the legs of the caisson. After being towed to the site, the platform was floated in among the three caisson legs and the brackets closed. The jacking system then was connected, and the platform was elevated, using cable jacks to position the bottom deck some 67 feet above the water surface.

The Future of Offshore Construction

Offshore structures for moderate depths, under 200 feet, are successfully in use in many parts of the world. The future development of structures for use in shallow waters probably will continue along presently established lines and be refined to extend the usefulness or to lower the cost.

For greater depths, platforms supported from the ocean floor do not appear suitable. The force of a deep water wave acting on such a platform would be so near to the surface that the overturning moment would be intolerable. The answer to the problem of operating in deep water may now be developing. In 1959 it was announced that the floating drill rig Cuss I drilled in 350 feet of water and set well casing to 6000 feet. The M. V. Submarex also was reported to have drilled experimentally in 1500 feet of water. These floating drill rigs are equipped with a derrick mounted amidship. In brief, the technique includes a method of setting a well head, working entirely from the ship above. This well head is firmly set and grouted in place and provides an anchorage for two cables that serve to guide all drill tools from the ship to the funnel-shaped mouth of the well casing. As yet there has been no announcement of a producing well in such deep water, but methods of handling such a well are being studied.

In deep water, a submerged structure attached to the ocean floor may be preferable, to avoid the force of waves and ocean currents above. How such a structure should be built, installed, and maintained, and how operations within the structure should be handled will be the problem. It could all be solved by remote control from the ocean surface, or provision could be made for manning such an ocean bottom structure. Existing techniques indicate that a manned underwater structure, accessible by submarine or bathysphere, could be designed today to withstand considerable depth. The advent of the nuclear submarine has demonstrated that personnel can survive for extended periods in properly designed vessels. However, the cost of providing, manning, and servicing a manned under-sea structure would be tremendous. Therefore, it is to be expected that the first attempts to produce from deep water will be made by using remote control, as was done in the floating drill rig operations already successfully demonstrated. □

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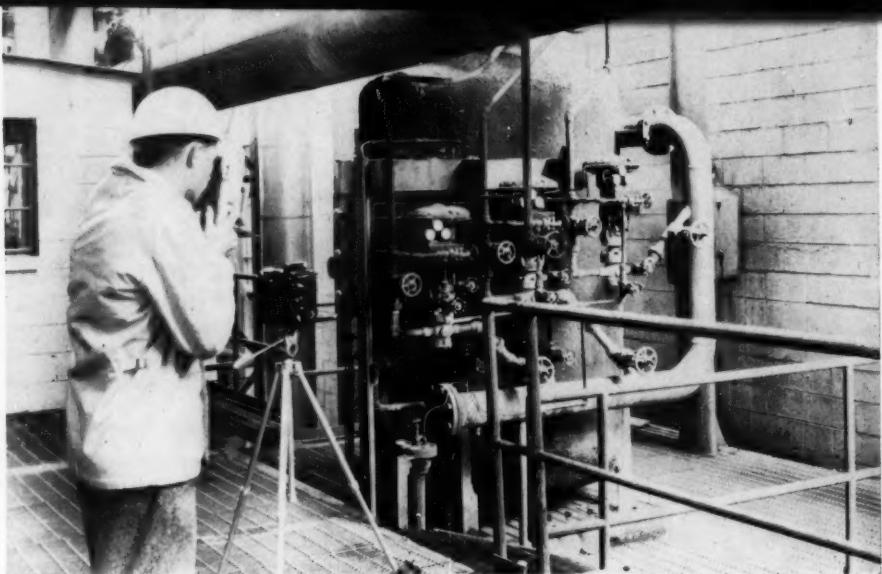
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1. The camera is set on a tripod in the selected preliminary position. Then a photograph is made with a Polaroid camera to determine whether the view will be adequate. The Polaroid print then is used to record field dimensions, thereby eliminating the need for freehand sketches, and also correlate and to identify the regular negative film.



Photodrawings Reduce Drafting Time

DANIEL F. SCHAUSS
The Rust Engineering Company

CONSULTING ENGINEERS engaged on projects involving changes in or additions to existing facilities frequently find that actual equipment layout seldom exactly matches the original construction drawings. In some instances there were important changes made that were not recorded on the drawing. In addition, the plant engineering staff may, over the years, have made many changes from the original. This means that even though drawings are available, it is necessary to go to the site to check the installation and correct the drawings before starting new design work. Often, there are no drawings at all, and dimensions and layout must be established before starting new work.

A unique and timesaving method of eliminating a certain amount of field work and most of the drafting is through the use of photodrawings. We have made considerable use of this technique at Rust Engineering and have found that it offers:

- ¶ More accurate information.
- ¶ Savings in engineering and drafting time.
- ¶ Construction savings resulting from a better understanding by field forces.

Probably the most important application of photodrawings is in the field of piping. The ap-

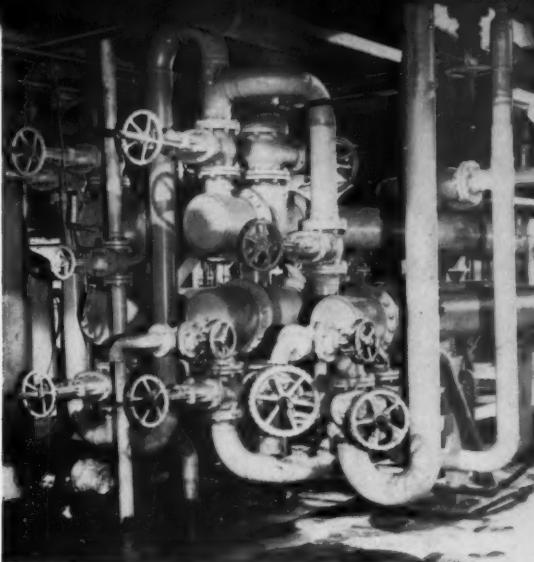
plication is evident when piping is a large segment of the work, particularly in the chemical process industry. In addition, the technique can be used for a wide variety of other applications including site clearance plans, electrical conduit and wiring installations, and certain structural modifications.

Photodrawings also can be used for presentation of maintenance information and production of record drawings.

How It Is Done

Correct type of camera, camera angle, appropriate film, and lighting is essential for a high quality work. Prior to photographing a subject for a photodrawing, a preliminary print from a Polaroid Land Camera will show whether the subject is properly covered from the selected camera position. This print is also useful for noting dimensional data. In a sense, this Polaroid print corresponds to the engineer's sketch.

The majority of photos can be taken with a camera having a normal lens; however, there are occasions where narrow spaces will dictate the use of a wide angle lens, and telephoto lenses will be found advantageous at times. A good camera and accessories should be used, but nothing is required



2. Typical print for use in photodrawing. Film rated ASA 200, exposure of 30 seconds at f32 with a single flash under normal plant lighting. The long exposure will let the plant lighting fill in some of the shadows. To photograph a room 75 to 100-ft long takes exposure of 1½ or 2 minutes at f32. A photo-flash is fired at a point 15 feet from the end of the room and again every 20 feet until a position even with the camera is reached. The same lighting can be obtained by using properly placed photoflood lights.

beyond the equipment normally owned by a serious amateur photographer.

Selection of view is dictated by the arrangement of the existing or proposed features — the process vessels, piping, or structural elements. A shot should be made wherever existing elements are to be moved or removed or where new construction is to be added. It is best to position the camera so that the angle described by the axis of the camera and the principal planes of the subject exceed 30 degrees. The effort should be to produce an isometric view of the subject, so that all additions can be drawn as isometric views to coincide with the photograph.

Most indoor locations are photographed by the open flash method. A long time exposure at a small aperture stop is made with one or several photo-flash lamps fired during the exposure.

Film processed in the conventional manner to a gamma of 8 usually provides the proper contrast negative. Some experimenting in developing films may be required insofar as contrasts and details are concerned. At this point several prints should be made, as these are useful in planning the final photodrawings.

An 8½" x 11" positive film enlargement is made from the original negative. During this enlargement the positive film is held in a vacuum frame or similar device in contact with a halftone screen. A 120-line screen gives good definition of detail.

One or more positive films, emulsion side up, are taped with a transparent mending tape to a tracing paper or cloth sheet. The tracing sheet with film attached then is placed upside down on a room light direct positive matte surface film so that the emulsion sides of the two films are in contact. An amber filter sheet is placed over the tracing sheet, and they are run through the exposure lamp of a

white print machine. The newly exposed film is then ready for immediate developing.

After the film is processed and dried, the engineering data needed to show the new work can be added. It should be kept in mind that the image is now on the backside of the film tracing, while all new work will be added top side of the tracing. Any deletion to background or image area may be scraped from back of film or crosshatched out.

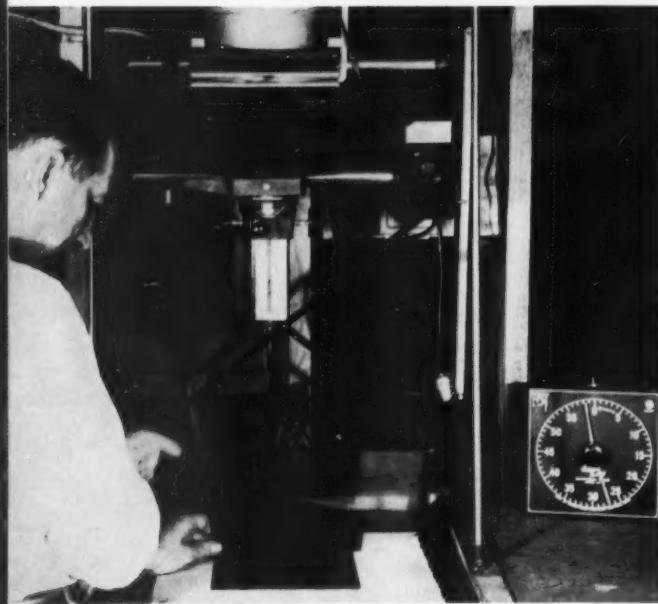
It generally is desirable to make a key or plot plan when several photodrawings are used. Each photodrawing is numbered, and a directional arrow with photo number is drawn on the plot plan. This will assist anyone to orient himself with relation to the camera position and the view angle.

Restoration Project

One recent Rust project provides a good example of the use of photodrawings. The work involved engineering and inspection services and the preparation of drawings to be used for soliciting bids for repairing facilities damaged by fire. Photodrawings of pipe insulation and pipe hanger damage proved entirely satisfactory. The drawings were prepared at approximately 40 percent of the estimated cost of preparing them by conventional drafting methods, and there was a considerable savings in time.

It was gratifying to find that the client, bidders, and craftsmen were enthusiastic over the use of photodrawings. We feel that this method offers many attractive aspects and should be used much more extensively by consulting engineers.

The Procter and Gamble Company, of Cincinnati, Ohio, has done a considerable amount of research work on photodrawings, and they have been influential in developing our interest in this method of preparing construction drawings.



3. The original negative is next enlarged to give an 8½" x 11" positive film. Then, as shown here, a piece of foam rubber ½-in. thick is placed on the easel. The positive film is laid on it, and a 120-line screen is put on top. This is covered by a ¼-in. clear glass. The weight of the glass gives a good contact between the screen and the negative film. A vacuum frame can be used instead if desired.



4. The enlarged and screened film is processed according to manufacturer's recommendations.



5. Enlarged films are taped to vellum tracing paper. Polaroid photos help set arrangement.

6. The next step is to transfer the image of the films taped on the tracing paper to a matte surface direct positive film. The matte surface film is the bottom sheet, emulsion side up, in direct contact with the film taped on tracing paper. An amber filter sheet is placed on top, and the material then is exposed by running it through the lamp assembly of a standard white print machine, as shown below.



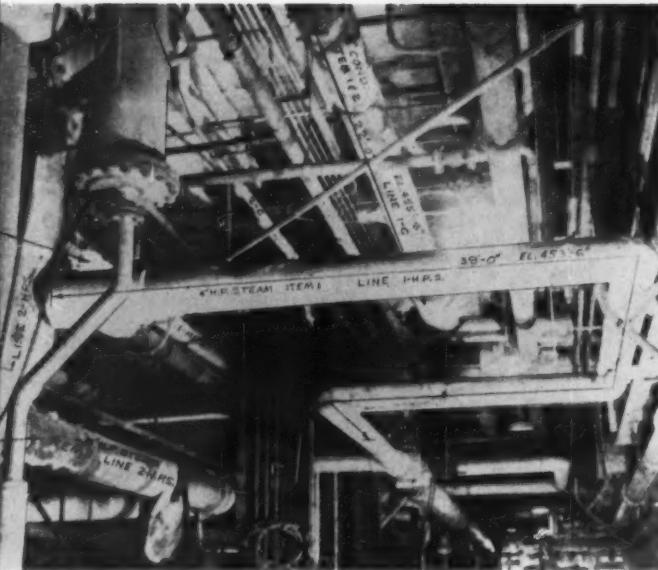
7. The new tracing film is processed in accordance with manufacturer's recommendations. After drying, tracing goes to the drafting room.



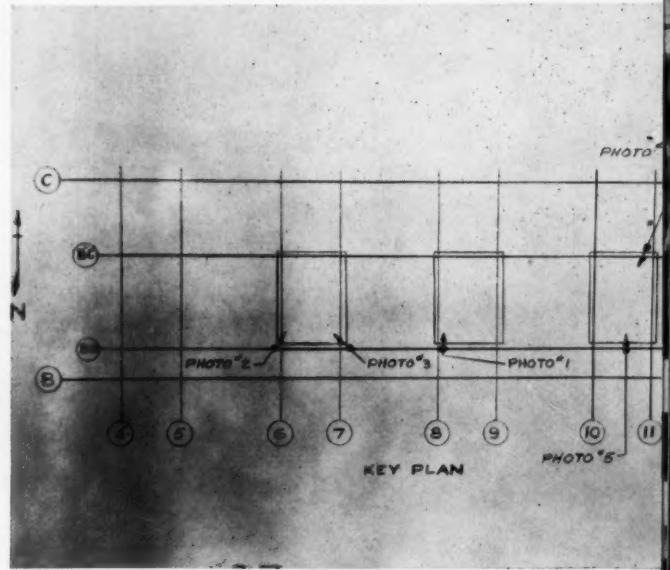
8. Under the supervision of the engineer, a draftsman, using the prints that were made from the original negative, sketches the necessary data.

9. All changes, additions, or deletions then are made on the photodrawing by the draftsman.





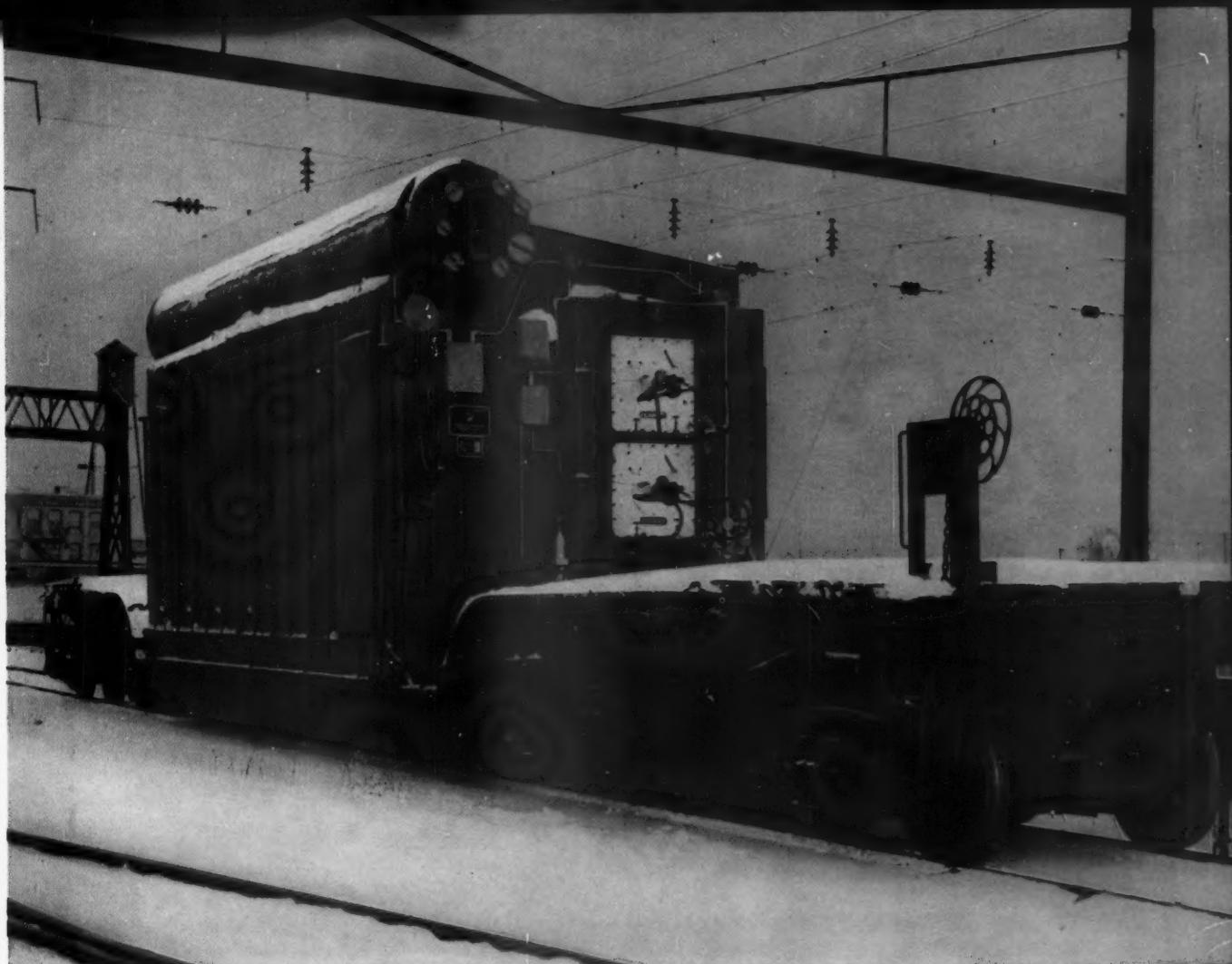
10. A section of a finished photodrawing as prepared by the draftsman shows the type of detail that is included.



11. Completed photodrawing also includes a key plan to orient user to the several photodrawings on master print.



12. White prints can be made from the tracing film just as prints are made from any other type of tracing.



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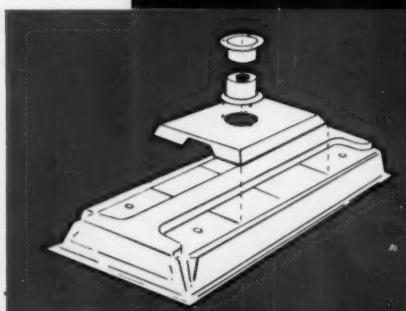
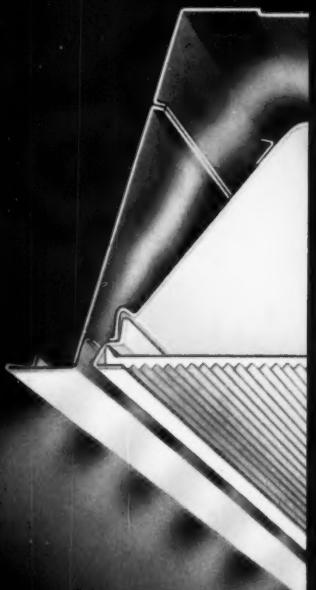
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other patents pending.

A new book, *Organizing the Technical Conference*, by H. S. Kindler, is being published by Reinhold early in June. The subject is one of importance to consulting engineers, for it seems that engineers in private practice, quite out of proportion to their number, are the leaders, chairmen, presidents, moderators, and directors of conferences and meetings. In this book Kindler tells how to go about initiating, planning, organizing, and conducting technical conferences. It is aimed at small to medium size gatherings, ranging in size from committee meetings to conferences of 500 or so. As the author points out, meetings involving thousands are conducted by professionals who do not need (or think they do not need) instruction in the art.

One chapter in the forthcoming book is of particular interest to every consulting engineer, joiner or not, for it tells how to conduct the small technical conferences such as most engineering firms hold from time to time. These may be staff meetings, or they may include some client's or prospective client's representatives. They may simply be called to permit a new product presentation by a sales representative. Whatever the reason, the meeting takes the time of expensive personnel and should be conducted so that as much value as possible is extracted.

The author, H. S. Kindler, is director of Technical and Educational Services of the Instrument Society of America. He and his publisher, Reinhold Publishing Corporation, have given CONSULTING ENGINEER exclusive permission to preprint this instructive chapter on "Committee Conferences" from the forthcoming book — a book that should be in every consulting engineer's library.

Committee Have Their

HERBERT S. KINDLER

SOME PERSONS prefer to resolve problems alone.

They claim that group deliberation is inferior to individual deliberation. Dr. Alan T. Waterman, National Science Foundation Director, said, ". . . the tendency of the group is to be conservative . . ." Howard Roark, protagonist in Ayn Rand's *The Fountainhead*, asserts more strongly, "There is no such thing as a collective thought. An agreement reached by a group of men is only a compromise or an average drawn upon many individual thoughts." Even men explaining conference techniques have written, "Honest, reasonable compromise is the essence of good conference work . . ." And, "There is give and take and compromise in a democratic discussion."

Without doubt a group can dilute potent ideas, dull keen insights, scar sensible proposals, and compromise flawless plans into oblivion; but individual creativity need not be submerged in group conformity. Productive, resourceful, efficient problem-solving conferences are possible.

Whether the committee conference compromises by taking the happy middle-road or rises to find the truly best solution depends on several factors. Have the most apt problems been chosen for group consideration? Have a capable chairman and team been selected? Will each committeeman have the opportunity to exercise his own problem-solving ingenuity before every conference? Can the chairman create an atmosphere in which each participant will be inspired to volunteer his best efforts?

Problems

What types of problems should committees tackle? The problem must be important, not only to the

CE exclusive

Chairmen Problems



Illustrations by Joseph H. Calley

organization but also to every committee member as well. Whether the banquet dessert should be petits fours or meringue glacée is not really a problem worthy of group resolution.

A committee should consider a problem only after all germane information is available. How many conference hours have melted away in torrid debate for want of a few facts!

Chairman

The chairman of a committee conference must be versatile. He should be able to think ahead with precision; phrase his thoughts clearly; react constructively to the unexpected; analyze personalities with sensitivity and acumen. He should have vitality, a sense of humor, tact, diplomacy, and an even temperament.

The chairman's resourcefulness is continually challenged by the conferrer's desire for self-recognition. Against his natural instinct, the conferrer is expected to throw his best ideas into the melting pot and watch them as they are stirred into anonymity. What does the conferrer gain? The chairman must conduct a meeting which will allow conferrers to sharpen their wits and to feel that they are playing an essential role in establishing important decisions as well as gaining the approbation of respected colleagues.

Conferrers

In choosing committee members, the chairman must anticipate likely problems in order to match the capabilities of the committee with the demands of the situation. A chairman should be as critical of potential committeemen as an attorney is of prospective jurymen. Each committeeman should

have enough initiative to analyze the problems from his own viewpoint, tenacity not to compromise without good reason, discernment to perceive how other ideas might improve his own, and confidence to accept the best decisions regardless of personality involvements.

Professor C. Northcote Parkinson describes the ideal deliberative body in a refreshing style. "We should eventually be able . . . to learn the formula by which the optimum number of committee members may be determined. Somewhere between the number 3 (where a quorum is impossible to collect) and approximately 21 (when the whole organism begins to perish), there lies a golden number."

The golden number for committees attempting to arrive at solutions to technical problems would appear to be between 8 and 12, the lower end of this range being preferred.

Preliminaries

Agenda — Never call a committee meeting without first distributing an agenda. Keep it brief but include meeting date and place, names and affiliations of committee members, starting time, planned duration, delineation of problems, and a statement of meeting goals. Append supporting data, tabulations, budgets, charts.

Such a problem-resolution plan will keep conferrers on the track, moving toward key points in logical sequence and on schedule; it will anticipate the need for supporting data, expert testimony, and time-saving visual and auditory aids.

Aids — Blackboards and flip pads are particularly effective for guiding the meeting. Simply listing all the "pro" arguments in one column and the

"cons" in another will focus discussion and speed decisions.

Some leaders delegate blackboard recording and summarizing to a secretary. This may be a mistake. If he does not grasp the crux of the issues, or if his phrasing is poor, a secretary may actually inhibit progress. On the other hand, an overzealous secretary may undermine a leader's initiative with statements like, "Would you restate that idea more concisely for the record?" or, "Let's finish this analysis before we move on." The chairman's role is to lead. He should consider managing his own visual aids, since they are easier to control than human beings.

Some leaders start their meetings by distributing masses of duplicated studies and statistics. The reaction of conferrers to those last-minute missives may vary from annoyance to open hostility. How can they be expected to participate actively if they are also expected to absorb the endless data heaped on them? Information may be presented in advance of a conference by memoranda, tables, charts, maps, and pictures; during a conference by slides, films, posters, blackboards, and magnetic board mock-ups. To distribute reams of information after a conference has convened is to invite distraction and frustration.

Physical Facilities — One last consideration, before the committee conference starts, is physical facilities. A dimly-lit, poorly-ventilated, drab, uncomfortable room with bad acoustics can wreck any meeting. It pays for the chairman to check the following points beforehand.

¶ Are seats arranged so that conferrers will be able to see each other?

¶ Can telephone interruptions be eliminated? At day-long conferences, or where calls must come through, a remote message-writer (which lights up when a message is being transmitted) might be convenient. Someone nearby simply tears off the written message and delivers it.

¶ Will visual and auditory aids be delivered in time to have them checked and have replacements made, if necessary? Are spare parts, like projector bulbs, available?

¶ Does the meeting room have dark shades, electrical outlets, and spotlights, if needed?



¶ If all committeemen do not know each other, have name cards been prepared?

¶ Have chalkboards, flip pads, chalk, erasers, crayons, felt ink markers, easels, pointers, thumbtacks, water, glasses, ash trays, coat racks, and other necessary items been provided?

Conducting the Meeting

The success of a meeting depends largely on its leader. Conferrers provide a motivating power which the leader must steer. Should committee conferences be democratic? Pure discussion is the essence of democracy, yet decisions are reached more slowly (and not necessarily any better) than if discussion is directed by a somewhat autocratic hand. Equal opportunity is desirable, and the conference leader should give all conferrers an equal opportunity to express their ideas. He need not give them equal time. He must assume responsibility for stifling unimaginative, cantankerous, or irrelevant remarks.

The technique of control lies in proficient questioning by the chairman. Questions effectively serve to introduce topics, provoke ideas, encourage participation, and modulate discussion.

Conference questions have been categorized as "overhead," "direct," "reverse," and "relay." Overhead questions are addressed to all conferrers and are particularly useful in starting and ending discussion. For example, the overhead question "Does the group believe that exhibits should be arranged in conjunction with the technical conference?" serves to start discussion. In like manner, the question "Does anyone have pertinent comments to add before we summarize?" wraps it up.

Direct questions are asked of specific persons to encourage participation, develop topics, elicit facts, rouse inattentive conferrers, prick expansive soliloquies, or harness meandering discourses.

Reverse and relay questions help the chairman maintain his impartiality. Suppose conferrer Fensitter asks, "In your opinion, Mr. Chairman, should we attempt prestressing of this unusual shape?" Mr. Chairman can avoid taking sides by asking a reverse question: "How do you see it, Mr. Fensitter. Do you think the cross-section is too small?" Or, he can broaden the discussion with a relay question: "Would Messrs. Brown, Jones, and Johnson offer their views on this problem? You have all seen recent European designs."

Despite such profuse questioning, conference chairmen must not become quiz masters. They do not interrogate to check a conferrer's knowledge but rather to encourage and direct his participation.

Obstacles

Visual and auditory aids, a problem-resolution plan, good meeting facilities, and thoughtful questioning all contribute to the success of a committee conference. Obstacles do exist, however, and they may trap a chairman and prevent his meeting from getting anywhere. A path circumventing these obstacles might be mapped in advance were it not for the unpredictable element present at every conference — people.

Some people who hinder progress are talkative, others are tightlipped. Some are aggressive, others retiring. Some are inscrutable, others transparent. Most appear reasonable — until they reach the con-

ference table. Then, as the agenda is unfurled, a subtle metamorphosis transforms everyday people into obstructionists.

There are no pat rules to guide the chairman. With his wits alone he must make allies out of adversaries. He can arm himself by knowing his enemy — by being on the lookout for: the purist, who is interested more in splitting hairs than in solving problems; the oversensitive egotist, who classifies all persons challenging his views as malicious vendettists; the dodger, who refuses to take a firm stand on any issue except sex and sin; the silent auditor, who takes in everything and contributes nothing; the stubborn reactionary, who opposes everything except "the way we did it the last time;" the relentless orator, who prefers talking to thinking; the infallible expert, who makes snap judgments about every question and defends his position to the end; the persistent plodder, who keeps reintroducing the same idea (in different words) after each rejection.

Let the following acrostic be your guide to conducting better meetings.

- C onvene on time. Invite comments on the agenda.
- O pen with a statement of objectives.
- N eglect no one. Encourage full participation.
- F ocus attention on conflicting opinions.
- E xamine facts before leaping to conclusions.
- R ecord highlights of conference deliberations.
- E ncourage evaluation. Ask probing questions.
- N ail decisions supported by the group.
- C onclude with assignments for follow-up action.
- E nd on time. Propose a date for the next meeting.
- S end complete minutes to each conferrer. □□



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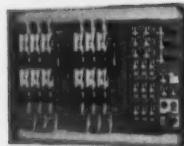
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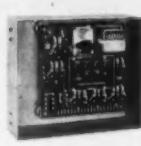
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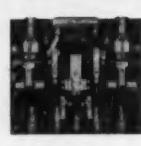
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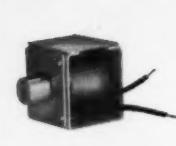
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Torque-Tension Tests For High Strength Bolts

M. ZAR
Sargent & Lundy

HIGH STRENGTH BOLTS as field fasteners for structural steel have established their superiority in less than five years.

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However, there are still a few uncertainties about their application, particularly in regard to the use of torque as a method for measuring tension. The desire to resolve these uncertainties is in no way a reflection on the value of the high strength bolt. On the contrary, it has uncovered knowledge that has added to the confidence that already exists in the ASTM A325 bolt.

Two objectives of recent field tests were: determination of the effect of the time interval between the installation and inspection of bolts, and the development of an accurate method of reading the torque. There was doubt that the torque reading obtained immediately after a bolt was installed would be the same as one obtained after a period of time had elapsed. Also, the torque values obtained by getting a reading as the nut is "cracked" (moved slightly forward) or by matchmarking the nut and the steel in the tightened position, backing off the nut, and then returning the nut to the original mark, seemed to vary considerably.

One important field experiment was performed at the Commonwealth Edison Company's Crawford Station, in Chicago. One hundred new $\frac{3}{8}$ -in. diameter by $2\frac{1}{2}$ -in. long A325 bolts were furnished by the Bethlehem Steel Company, from the same heat and cut on the same machine. This eliminated as much as possible any torque variations resulting from bolts of different manufacture or steel chemistry, or differences in the amount of antirust liquid.

In order to determine the characteristics of these bolts, tests were performed on seven of them by tightening and re-tightening each one to various tensions with a torque wrench in a Skidmore-Wil-

helm calibrator. The tension and corresponding torque for each position for each bolt are given in Table I. Bolt #1 was tested to failure, which occurred when the bolt broke through the threads

TABLE I

Bolt Number and Position	Tension Lbs	Torque Ft-Lbs
#1 - Installed	35,000	325
Back-off and return	35,000	300
Back-off and return	35,000	305
#2 - Installed	35,000	360
Back-off and return	35,000	360
Back-off and return	35,000	360
Back-off and return	35,000	340
#3 - Installed	35,000	385
Back-off and return	35,000	375
#4 - Installed	37,000	420
Back-off and return	32,000	420
Break-forward	37,000	520
#5 - Installed	35,000	380
Back-off and return	37,000	380
Back-off and return	37,000	380
Back-off and return	33,000	320
#6 - Installed	32,400	320
Back-off and return	32,000	290
Back-off and return	35,000	320
Break-forward	35,000	360
Back-off and return	32,000	315
#7 - Installed	37,000	380
Break-forward	37,000	380
Back-off and return	36,000	340
Break-forward after 10 minutes	36,000	350
Back-off and return	35,000	320

with a loud explosion at a tension of 65,000 lbs. The tension-torque curve is shown in Fig. 1. Bolt #2 was left in the calibrator for two hours at 35,000-lbs tension, with no loss in tension during this period.

A column splice connection with a short grip was selected in the Crawford Unit No. 7 boiler room

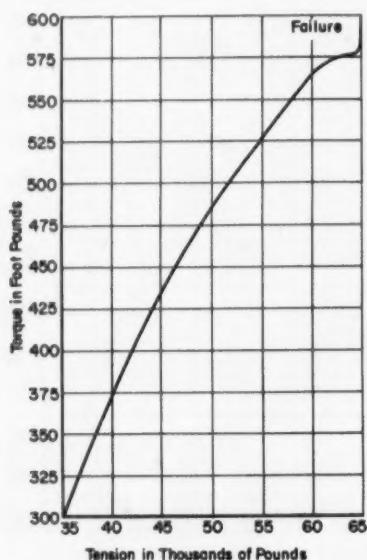


Fig. 1 - Failure test curve of Bolt #1.

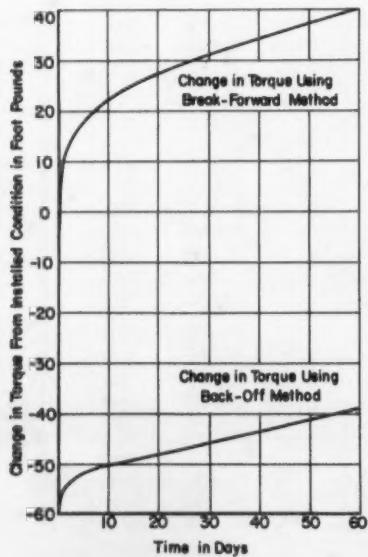


Fig. 2 - Inspection method comparison showing changes in torque with time.

to best utilize the short 2½-in. bolts. If longer bolts were tested, the calibrator would have to be packed with washers in order to tighten the nut. This would introduce another variable because of the torque needed to compress the washers. Four new bolts were each placed in the calibrator and tightened to 35,000 lbs. The dial on the torque wrench was read for each bolt and recorded. Each bolt then was placed in the column connection and torqued to the recorded reading. The bolts were checked with the torque wrench after an interval, and in each test it was observed that it took more than the original torque to crack the nut and less than the original torque to return the nut to the matchmark after backing it off.

Precise Test Methods

Variations in the data shown in Table 1 emphasized the need for an extremely delicate and careful additional experiment to insure well correlated and accurate results. The wrench chuck and the steel were marked and read very precisely. All nuts were made finger-tight before torquing in the calibrator. The wrench handle always was kept on the right side when the dial was set and when it was read, since the weight of the wrench exerts a torque. This also eliminated any error due to play in the chuck. The bolts were handled so as to avoid removing any of the liquid or grit that was on them when shipped. In tightening the nut, the motions were kept as smooth as possible and jerking was avoided.

The final experiment was performed as follows:

¶ A new bolt, nut, and washer were placed in the calibrator.

¶ The torque wrench was hung horizontally off to the right of the nut after the nut was brought up finger-tight, and the torque dial was set at zero.

¶ The nut was tightened till the calibrator indicated a tension of

32,400 lbs — the required minimum tension for ¾-in. diameter bolts. Then the torque on the wrench was read and recorded, making sure that the wrench handle was approximately horizontal again on the right. (With a ratchet on the chuck, this was not difficult to do.) About ¼ of a turn from the finger-tight position was required to reach this tension value.

¶ One existing bolt in the center of the column splice was removed and discarded along with the nut and washers. By removing only one bolt and using the hole surrounded by tight bolts, there was a good guarantee that the splice plate and fill were properly drawn up to the column flange. The calibrated bolt assembly was removed from the calibrator and installed in the hole in the splice connection.

¶ The bolt was tightened till the torque level recorded on the calibrator was reached, again ending with the wrench weight horizontally on the right.

¶ Another old bolt, not adjacent to the new one, was removed and discarded, and the hole was filled with another new calibrated bolt as described before.

Check Tests

In similar manner, each bolt was installed in the structure with the torque value that it alone required to bring it to minimum tension in the calibrator. Then after a prescribed interval, which varied from 10 minutes to 56 days after the bolts were installed, each bolt was checked as follows:

¶ The column steel and chuck were matchmarked, again with the weight of the wrench horizontally to the right.

¶ The torque was read and recorded as the nut was "cracked" forward. (Extreme care was required to keep the actual nut movement to a minimum.)

¶ The nut was backed-off about ¼ turn, then re-tightened to the mark and this torque reading taken.

¶ The bolt was removed from the

column and placed with the nut and its washer in the calibrator. A torque reading was taken as the bolt was tightened to the original tension of 32,400 lbs. Tension readings also were made as the back-off and break-forward torques (as determined in the column) were reached and when the wrench dial indicated that the original torque used to calibrate the bolt was attained.

Individual bolts were tested in the column after an elapsed time of either 10 minutes, 30 minutes, 1 hour, 2 hours, 6 hours, 24 hours, 7 days, 28 days, or 56 days. As many as 25 bolts were tested at each time interval, but no one bolt was used in more than one test. In spite of the precise technique used in the testing, variations of 50 ft-lbs sometimes were obtained. The curves in Fig. 2 are the approximate average readings.

Conclusions

On the basis of these tests it was concluded that inspection by the break-forward method always will give a higher torque reading than the back-off method. The break-forward reading increases markedly, the longer the interval between installation and inspection. Thus, though the break-forward reading can appear to be satisfactory, it will be erroneously high if inspection is made after a long period.

Although torque readings increase with time, the back-off method continues to give values below the installed torque, probably because of the wearing of the burrs on the threads. In addition, the back-off method is exacting and difficult to apply in the field with laboratory precision. It also is time-consuming. Bolts retested in the calibrator invariably required less torque to reach minimum tension than they did before installation in the column, probably because of the smoothing out of irregularities in the threads. At no time was a one-half turn on the nut from the finger-tight position inadequate

for providing more than minimum required tension.

On the basis of these tests, Sargent & Lundy has established detailed specifications for the in-

stallation and inspection of A325 bolts. A 3300-ton structural steel addition to the Crawford Station has been erected under these specifications with excellent results. ▲▲

Specifications for Installation and Inspection of A-325 Bolts

(Based on experiments at Crawford Station, Commonwealth Edison Co.)

Contractor shall furnish and install high strength bolts in accordance with the latest edition of "Specification for Assembly of Structural Joints Using High Strength Steel Bolts" as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation. The following requirements shall also apply.

A. The procedure for the assembly of joints shall be as follows:

1. Fair-up holes in each connection with enough pins to maintain dimensions and plumbness of the structure. These pins shall remain in place until all the bolts in the balance of the holes have been tightened.
2. Install and tighten enough fit-up bolts to insure connected parts are properly fitted. Permanent high strength bolts may be used for fit-up.
3. Install bolts in the remaining holes and spin the nut on each of these bolts to a snug condition with an impact wrench, then continue to tighten it at least an additional one-half turn. The chuck of the wrench must be marked to permit visual observation of its rotation.
4. Replace pins and temporary fit-up bolts, if temporary fit-up bolts are used, with high strength bolts and tighten as specified in Step 3.
5. If permanent high strength bolts are used for fit-up bolts, check the tightness of each fit-up bolt with the impact wrench by tightening one-quarter turn. If these bolts do not appear to be tight, they shall be made snug and impacted one-half turn as specified in Step 3.

B. Inspection shall be performed in accordance with the following:

1. Each day three bolts of each required size shall be tested in a tension device such as the Skidmore-Wilhelm calibrator.
2. Bolts shall be tightened to the following tension in the calibrator:

Bolt Size, Inches	Required Minimum Bolt Tension, lbs
5/8	17,250
3/4	25,600
7/8	32,400
1	42,500
1 1/8	50,800
1 1/4	64,500

3. The inspector, by means of a calibrated torque wrench, shall test the torque on each tightened bolt in the calibrator by attempting to tighten the nut a very small amount and average the readings on the three bolts. He shall add 50 ft-lbs to this average [to recognize that the break-forward reading is probably higher than the installed torque, even if the nut is barely rotated] to establish a torque-tension relationship for each bolt size, and this relationship is the norm by which he shall check bolts for that day.
4. In each connection on the structure, approximately 10% of the bolts shall be tested, but never less than two.
5. In testing, the inspector shall place his wrench on the nut, read the dial on his wrench, while attempting to tighten the nut a very small amount, comparing this reading with the required torque established in Step 3 above.
6. If the inspector discovers one or more bolts which are under-torqued, all bolts in the connection shall be tightened with an impact wrench by the erector and shall be checked again by the inspector.

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Field Notes

MARJORIE ODEN,

Eastern Editor

We Give You
The Small Hello . . .



THERE IS in New York City a small group known as the American Council for Emigres in the Professions. The National Science Foundation, church organizations, and many other groups send professional people to the Council for help. Many of them are engineers, once prominent in their own countries, who now are working as janitors or factory workers because they have been unable to get professional positions in this country. It sometimes seems that a foreign accent means being given a bad time when it comes to registration.

Case History

George Bajos, one Hungarian refugee, whose true name is different, has a typical story. He is 44, and has had eight technical books published, mostly in the fields of hydrology, irrigation, and drainage. He has eight years teaching experience in European universities, and 16 years of practical experience. Today he is in New York City, making \$5500 a year on a construction job.

One of the first things Bajos did when eligible was apply for his New York registration. He was required to submit approximately 65 pages of documents to substantiate his credentials. He did. The next request was for an additional 15 pages of documentation. This was

submitted. Then Bajos, with his experience as a university teacher, was required to produce a high school graduation certificate. He took an 11-hour examination, which he passed. Now he has been notified that he may not be able to take the May 1960 test because he does not graduate from his English courses until May — despite letters from two university professors of English saying Bajos speaks and writes good English and is sure to pass the courses. If not allowed to take the registration examinations in May, he then will have to wait for another year.

The engineer being treated in this manner received a civil engineering degree, summa cum laude, from a technological institute, in Budapest. To round out his education, he then continued his studies at the Italian University for Foreigners, in Perugia, where he received a certificate in Italian, literature, and history.

During the War years, Bajos was an officer doing bridge and highway design, river engineering, and flood control work, along with fortification, for the office of the Ministry of War, Budapest. At the same time, he was assistant professor of river engineering, highway and bridge construction, and mathematics, at Military Technological College, Baja, Hungary.

After the war, he was offered a project as consulting engineer doing highway and bridge design, in Turkey. He was given permission to leave Hungary, but told he must leave his wife and eight-months-old daughter behind. He turned down the project. Then he, his wife, and daughter escaped to Poland where they got forged papers covering their illegal entry. However, they were placed on the "wanted" list in Hungary.

Before long, he was in charge of the Office for Water Treatment in a Polish city, as well as teaching water treatment in a technological college. But in 1953, someone found out about his forged papers, so he was sent to prison. Rather than waste his time, he wrote a book on "Water in Agricultural Engineering," which was printed the year after his release.

When Stalin died, tension was eased; many prisons closed, including the one in which Bajos was prisoner. Because there was an acute shortage of engineers, he had no trouble getting a good job. He was a civil engineer on architectural works, sanitary engineering, and highway and bridge construction for a state-owned firm in Krakow, Poland.

All was quiet for awhile. Trouble came when awards were given for outstanding work. The awards were

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MEMBER AIR MOVING & CONDITIONING ASSOCIATION, INC.

trips to Russia and East Germany to inspect projects there. Twice Bajos' name was removed from the list, and he soon heard that he was reported to be on the political list of non-Communists. "I was getting nervous," he added.

Then, another trip was scheduled to a satellite country. Since the other trips had been denied him, he figured the best defense was a good offense, and he complained loudly. This time his superior added the names of Bajos and his family to the traveling list at the last minute.

While on this trip, and later on subsequent ones, he tried to escape. "Once I bribed two border guards. But they took the money and disappeared before I could get to the border with my family." Finally relatives in New York City arranged for the trip to the U.S.

Making Progress

Though Bajos could speak Czech, French, German, Hungarian, Italian, Russian, Serbo-Croatian, and Polish, he had not learned English. The first thing he did upon arriving in New York was take some basic English courses in night school and enroll in two graduate engineering courses. He also supervised construction of a \$750,000 apartment house that year.

Today he speaks with only a slight accent. And he proudly mentioned that his 11-year-old daughter (who speaks German, Polish, Czech, and Hungarian) has learned enough English to win a scholarship to a Catholic high school in New York City.

One group has not doubted his ability. He has been made a full member of the American Society of Civil Engineers, in the hydraulics and sanitation divisions.

Diverse Results

Miss Marie Reith, P.E., who has been active in the New York State Society of Professional Engineers for some time and formerly was with Consolidated Edison Com-



The only preventive maintenance required on a Vibra-Grate Stoker is for a mechanic to grease it every three months at four points on the front.

AT SPAULDING FIBRE COMPANY
(makers of ARMIT, SPAULDITE fibres and plastics)

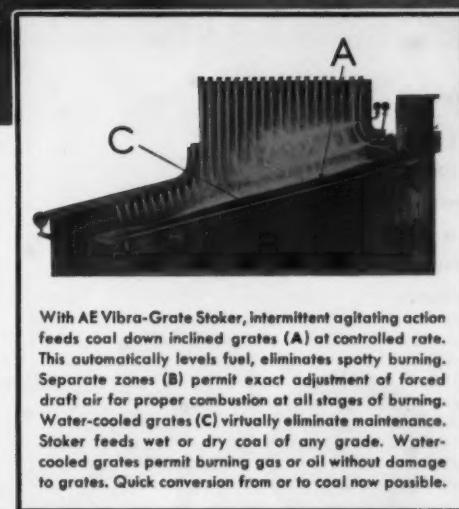
Vibra-Grate Stokers save 1000 tons of coal per year!

The two 50,000-lb AE Vibra-Grate Stokers shown above went on line at the Tonawanda plant of the Spaulding Fibre Company in 1958.

Cost and performance data for the two-year period to January 1960 are reported as follows:

Total coal consumption (both units), 26,472 tons; an estimated savings of 2,000 tons compared with other stokers in the same plant. Superior air zoning increases combustion efficiency at all loads. Average evaporation on one unit is 10.6 lb of steam per pound of coal and 10.8 on the other, using coals having an average Btu value of 13,173.

To cap it off, the company reports maintenance costs are much lower than those of other types of stokers in service, and . . . "efficiency and operating economies far in



With AE Vibra-Grate Stoker, intermittent agitating action feeds coal down inclined grates (A) at controlled rate. This automatically levels fuel, eliminates spotty burning. Separate zones (B) permit exact adjustment of forced draft air for proper combustion at all stages of burning. Water-cooled grates (C) virtually eliminate maintenance. Stoker feeds wet or dry coal of any grade. Water-cooled grates permit burning gas or oil without damage to grates. Quick conversion from oil to coal now possible.

excess of the manufacturer's guarantee and our highest expectations."

In every installation, and under the most critical observation, time and usage are proving the peak efficiency, and the almost total elimination of maintenance costs, possible with the exclusive AE Vibra-Grate Stoker design. No other stoker combines the advantages of vibrating grate feed, water-cooled grates and precision-controlled air zones. Write to Dept. S-111 for copies of plant operating reports and AE Vibra-Grate Stoker Catalog S-546-A today.



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Division of United Industrial Corporation
Wheatstack Lane & Sepviva St. • Philadelphia 37, Pa.

Canadian Subsidiaries: Affiliated Engineering Corporations, Ltd., Montreal, P. Q. • Bawden Industries Ltd., Toronto, Ont.

pany of New York, Inc. until her retirement, spends her full time trying to find professional jobs for the engineers like Bajos who go to the Council for help. She runs into some amusing situations and some pathetic ones.

One professor from Germany was given a job teaching engineering in an American college. A few days later he was back at the Council offices, much upset at his students because they had been insolent.

It turned out the students had asked questions at the end of the lecture. The German was used to students being seen but not heard and thought they were questioning his knowledge.

Then there was the professor who was given a job teaching in a Negro college in the South. He got along well at school, but he was ostracized by the white citizens. The Council got him another job teaching in a New York State university.

One young architect went to the Council for help. He owned only one suit, which he had purchased from the Salvation Army. Unfortunately, the suit showed its heritage. Miss Reith sent him to a New York architect's office for an interview. He did not get a job. But the architect did send Miss Reith some money anonymously with the request that it be given to the youth for clothes.

There also is the young Bulgarian electrical engineer, who was hired by Samborn, Steketee & Associates, Otis and Evans, in Toledo. His first postcard back to the Council said: "I stay at Toledo. It like me. I thank you." Miss Reith said his English has improved since then, and Toledo and his firm still like him.

Deserve a Chance

Many of the stories do not have such happy endings. A 48-year-old Bulgarian electrical engineer currently is working as a janitor in a New York City church. He was chief engineer from 1950 to 1958 for the U.S. Army, in Munich, on some electrical engineering projects. But he does not speak English yet, and as a result he does not have his registration.

Another 44-year-old Hungarian is a specialist in underground structures and reinforced concrete design. He speaks with a heavy accent, and currently is unemployed. This worries him more than most because he has learned that for about \$4000 he has an opportunity to get his two young sons out of Hungary next fall. This man once supervised a design staff of 30 engineers in a government bureau, and was so respected that during his waiting period in Vienna (before obtaining permission to come to the United States) the Technical University offered him a temporary teaching position.

Miss Reith can tell you of many other highly qualified engineers, who ask only to be given a chance to practice their profession. ▲▲

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ENGINEERING DATA • SELECTION INDEX



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by tests regularly, at E.T.L.*



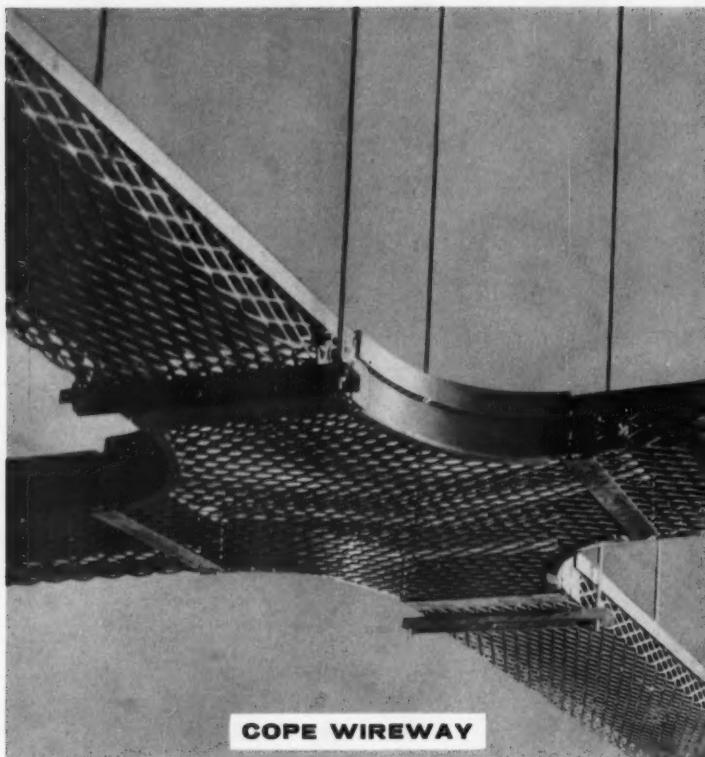
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Wireway's strong, expanded type construction uses *less* metal to handle *more* cable. For example, one 24" wide section of Wireway can support *as much cable* as sixteen lengths of 4" conduit. That adds up to substantial savings on any size job.

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Consider these advantages of Cope Wireway. Then let an authorized Cope Electrical Wholesaler prove how a Cope cable supporting system can save money in your plant.

ALL COPE CABLE SUPPORTING SYSTEMS ARE AVAILABLE IN ALUMINUM OR HOT DIP GALVANIZED STEEL
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Sold only through authorized electrical wholesalers



A. J. Blaylock and Associates, structural design and civil engineering firm, occupies second floor area between office quarters of two testing firms.



Philip Helsley, president of Testing Engineers, Inc., in his new office.

San Diego's Newest Engineering Building

TWO TESTING engineering firms and a consulting engineer are the tenants in San Diego's newest engineering building. Designed primarily for test work, the structure has ample room for expansion. In the interim, this expansion area provides attractive quarters for the structural design and civil engineering firm of A. J. Blaylock and Associates. The remaining space is occupied by the testing firms of Woodward-Clyde-Sherard and Associates and Testing Engineers, Inc. Plans and working drawings for the new building were prepared by the firm of Richard George Wheeler and Associates, architects and engineers.

Since the structure was designed primarily for test engineering services, it was built with many different types of materials which were carefully tested before use. Although soil conditions were good, the water table was at the 8-ft level, and reinforced concrete

footings ranging up to 5-ft wide were used to support the building. The front section of the structure was designed with reinforced concrete columns and beams, other areas with reinforced brick masonry, and the rear section with 8-in. reinforced concrete block. The rear area is a one story structure.

The first floor slab is of 4-in. thick concrete on controlled fill. The second floor is constructed with open web bar joists, metal decking, and a 2½-in. concrete slab. Electrical ducts were placed in both floor slabs, to provide electrical outlets for both 110 and 440 volt service throughout the building. Roof construction is of 12-in. I-beams with 8-in. joists and hangers covered with a 1-in. sheathing and composition roofing. Main floor areas are covered with asphalt tile, but ceramic and vinyl asbestos tile are used in washrooms.

The entire structure is designed without supporting interior col-



Laboratory areas of Woodward-Clyde-Sherard and Associates are confined to first floor area. Test data is sent to second floor office via dumb waiter.



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TYPE "MC"

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general purpose in-
dustrial applications.



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tional applications that
call for maximum
space savings.

umns to provide complete layout flexibility. Ceilings have acoustical tile and tube lighting which can be easily altered to provide maximum lighting for any desired arrangement of the interior.

Built on an acre of land, the new building has ample parking area. The visitor enters an attractive lobby in the center of the first floor. The front entry canopy is an exposed structural steel frame covered with metal decking, all painted blue. Floating over the canopy is a 20-ft by 16-ft mosaic tile panel screening the two-story glass entry. Tiled on both sides, it presents an interesting view from both outside and inside the lobby. A wing wall on the west side of the entry is of sand blasted reinforced concrete, with exposed aggregate forming an interesting surface pattern.

Inside the entry, and behind the reception area, is an open work concrete block panel which screens the passage between the two major office and laboratory areas. Executive offices of both testing firms are on the second floor, as are the offices of the consulting firm. An exposed steel stairway with terrazzo filled treads leads directly to this office area.

An important design feature of the building is the complete separation of the laboratory work and the paper work. All testing is done on the first floor, with only the test results going to the second floor via a dumb-waiter. Soundproofing material is used in the second floor areas, giving complete privacy and low sound levels for conferences and routine office activities. All noise is limited to that created by normal office activity.

The building is heated by a gas-fired hot water boiler rated at 240,000 Btu per hour, with automatic firing controls to maintain a 180-degree boiler water temperature. The air conditioning system does not presently provide for cooling, but space has been provided for 8-row water cooling coils. □

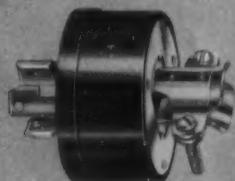
NEW HART-LOCK HEAVY DUTY DEVICES FOR INDUSTRIAL INSTALLATIONS



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Developed to insure safety in heavy-duty installations, this new line of Hart-Lock devices provides complete protection for industrial and commercial equipment that operates on 250 volts. The receptacle has black, glazed porcelain finish contact face, or is available with "NO-TRAK" face for heavy-duty industrial equipment. Serrations around terminal screws provide a secure grip for wires. Configuration prevents interchangeability with 20 amp Hart-Lock caps, connectors and receptacles. Caps and connectors have rubber ridge for better finger grip. Available in Arrow-Hart's exclusive armor-over-rubber construction. Grounded units are also available.

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Flow-stopping, pipe-clogging roots . . . no matter how cobwebby-thin . . . can't penetrate the exclusive patented "K&M" FLUID-TITE coupling . . . unmatched in its tight sealing. In repeated tests, "K&M" Asbestos-Cement Sewer Pipe successfully resisted infiltration even when external water pressure was 25 psi . . . the equivalent of a 58-foot head and way above field conditions.

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In fact, "K&M" Asbestos-Cement Sewer Pipe is a tax-saver at every stage of construction: planning and installation, as well as maintenance. Transportation and handling is less expensive, because "K&M" Asbestos-Cement Sewer Pipe is light in weight.

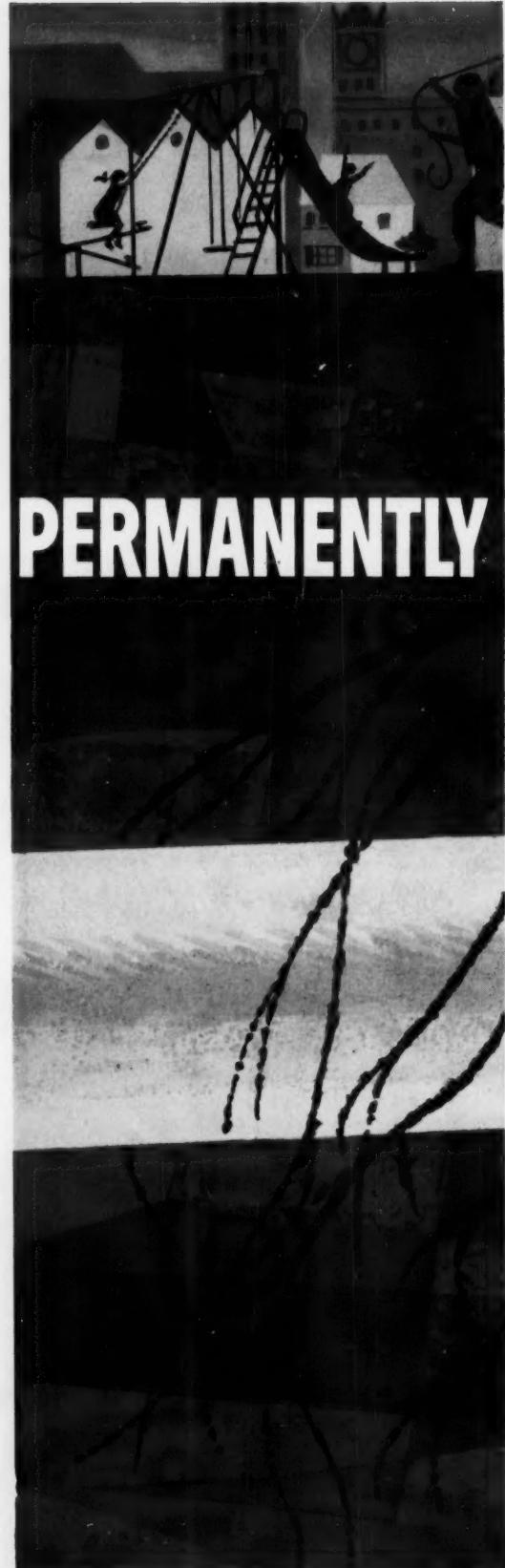
In short, practically indestructible materials plus eighty-five years of asbestos engineering give you the finest, most dependable sewer pipe available. That's why we urge you to write today for more information. Dept. P-1250

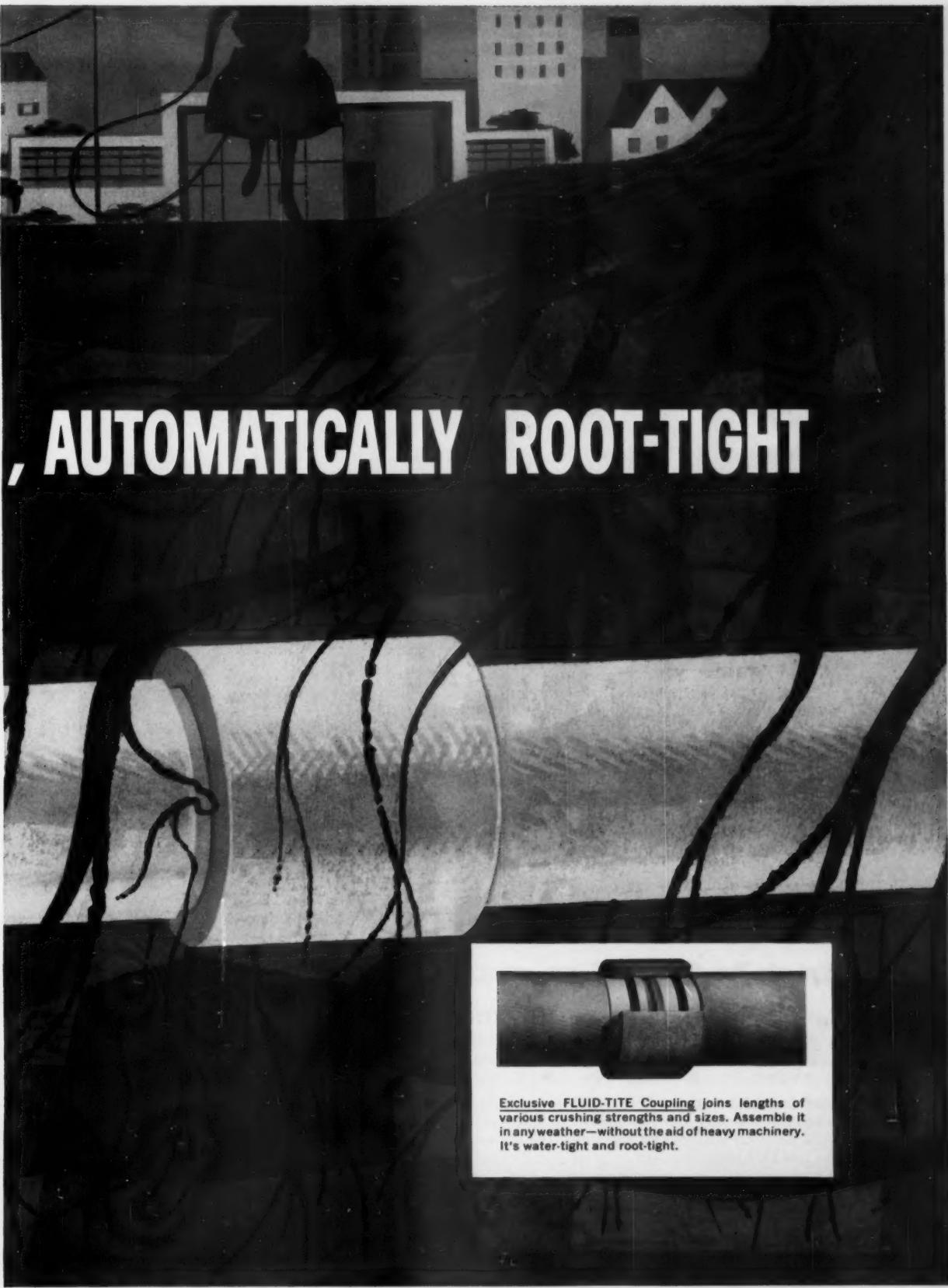
5 CRUSHING STRENGTHS OF K & M SEWER PIPE

Size Inches	Class 1500	Class 2400	Class 3300	Class 4000	Class 5000
6	1600	2400	3300		
8	1600	2400	3300		
10	1600	2400	3300	4000	5000
12	1600	2400	3300	4000	5000
14	1600	2400	3300	4000	5000
16	1600	2400	3300	4000	5000



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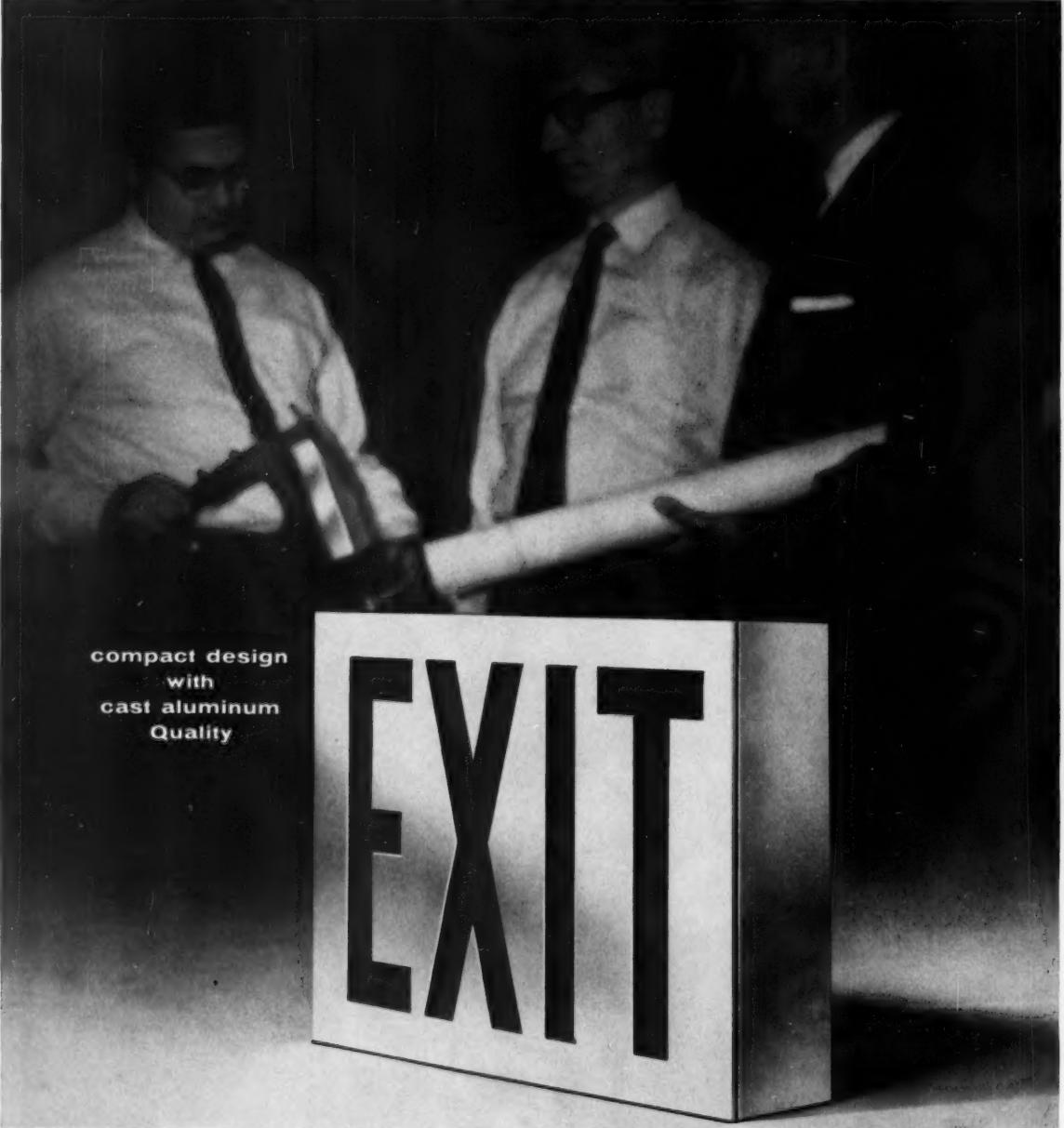




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compact design
with
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. . . the new EXIT unit with ONLY 2 INCHES of apparent thickness in the flat wall mounted series. 50 line by mcPhilben is designer styled to blend with any prestige decor in Hotel Lobbies, Auditoriums, Office Buildings, Schools, Libraries, Hospitals, Court Houses and other public locations.

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33a

Mc

Building Research Institute...

- Developing a Building Science
- Building Survey Report

THE Building Research Institute, at its recent meeting in New York City, concentrated on communications — its own and those of the industry. In a report which was adopted unanimously by the Board of Governors, the BRI research committee pointed out that two general conditions are retarding the rapid development of a building science. First, the considerable fund of pertinent knowledge extant is widely scattered and not readily available, and second, there is no centralized agency for documenting it. Through its conferences, BRI is tackling the first problem. And through a broad new program, to go into effect next January, it hopes to cope with the second problem.

The current publication, which is now sent to members quarterly, will be converted to a monthly newsletter, thus giving BRI officials more opportunity to communicate with the membership. At the same time, mentions of current articles or books will be carried.

A professional in abstracting and indexing is to be retained to establish an abstract department which will deal principally with research reports from industry, private and college laboratories, government agencies, and other groups not covered in current abstracts. A comprehensive system of indexing, based on the "Practical System for Documenting Building Research," as presented by Eugene Wall at the fall meeting, is to be established.

Also at the meeting in New York City, a number of sessions were devoted to establishing a channel of "feed-back communication from building owners and operators, whereby information on performance and upkeep of buildings and building components can be made available to architects, builders, manufacturers, and building research groups."

In his introduction to the sessions, H. E. Phillips pointed out that the right kind of information on materials sometimes does not reach the right people. Some reasons for this are:

- ¶ The producer very naturally wants the world to know only about his product's good points.
- ¶ The specifier does not want it thought that his choice of products and techniques could stand improvement.
- ¶ The builder wants no possible reflection on the excellence of his work.
- ¶ The owner, especially if he is renting out his space, does not want anything published indicating that this building has any faults.

Survey on Building

One of the most interesting things discussed at the BRI meeting was a survey sent to 110 schools, hospitals, colleges, and universities throughout the country. It was designed to find out how the various materials used in institutional buildings are holding up. The survey respondents were painfully honest. In fact, a recom-

mendation was made that a better method be found for gathering information in the future than taking a survey.

Among the general findings was the fact that geographical location has little bearing on maintenance problems. Only two exceptions were mentioned — freezing cycle effects on exterior walls and salt air. Among the specific problems building owners and managers thought deserving of study for possible improvements were:

- ¶ Crowded and inaccessible mechanical equipment.
- ¶ Poor supervision during the construction period.
- ¶ Cramped main electrical equipment rooms.
- ¶ Inaccessible piping, valves, and similar equipment.
- ¶ Too much aesthetic consideration by architects, resulting in the sacrifice of practicality.
- ¶ Sacrifices of quality to low first cost that result in high and continuous maintenance costs.
- ¶ Insufficient time allowed during design stages.

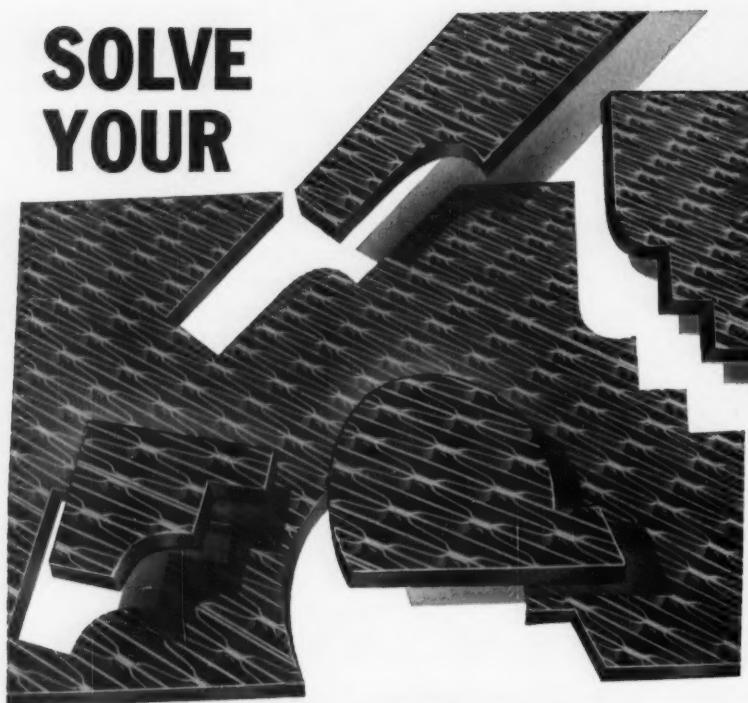
Some Survey Comments

Other rather general comments were concerned with the need to reduce noise transmission through improved wall and door construction, and a need to concentrate on workmanship as well as on materials and design. Excerpts from the survey follow:

"The roofing material manufacturers are doing a good job, and their problems appear to be entirely a matter of workmanship. Copper or coated copper is outstanding as a flashing material. Good results with coated steel are the exception rather than the rule.

"Too much care cannot be exercised in the installation of roof drainage systems. Gutters of all types are highly unsatisfactory in areas of the country where heavy snowfall takes place. Owners must understand that regular inspection and proper cleaning of roof drainage systems is essential. It is too

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If you need a grating that must fit around pipes and other objects, like a complicated jig-saw puzzle, there's one way you can be sure of getting panels that will fit perfectly into place—specify IRVICO.

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late when a drain or a downspout becomes clogged.

If an owner insists on hard-surface roof deck areas, extreme care in the selection of materials and installation of same is essential. Movement due to temperature changes is most difficult to overcome, and all such surfaces should have the regular roofing felts properly mopped in under same. It is significant that seven owners recommended the use of roof decks be avoided except for the normal purpose of a roof.

"Good masonry for exterior walls rates very high with owners who maintain them and depend on them for weathertight performance. It is surprising that so few owners had comments on the new so-called 'curtain walls.' This would indicate that it will be several years before the good or bad features of this modern wall construction are known.

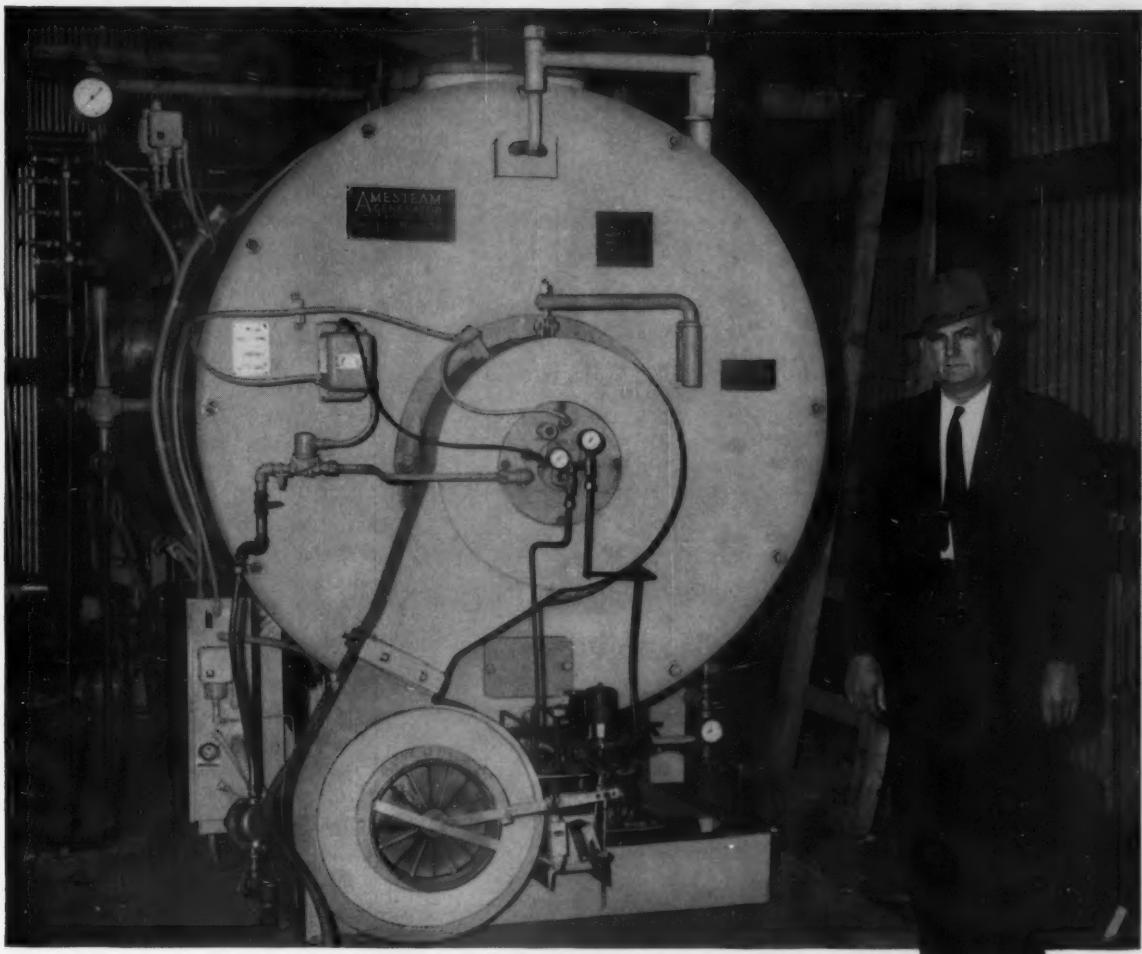
"For institutional use, the window manufacturers should not overlook the popularity of the double-hung window.

"Generally speaking, interior walls and finishes are doing a very good job except for painted wall-board partitions. These apparently need much improvement.

"Modern floor materials are doing a very good job. It would appear that paint manufacturers still have to develop a product which is suitable for use on concrete. Quarry tile is outstanding in food preparation and serving areas, and hardened concrete is by far the most popular for hard-use service areas — e.g., shops and warehouses.

Mechanical, Electrical Problems

"Modern heating systems generally appear to be satisfactory, but should be further refined by better temperature control systems. Ample room and accessibility of maintenance equipment and piping are essential. Plumbing systems seem to be good. Most complaints are in connection with noise. These noises include flush valves, water



"We are well pleased with the 150 HP Amesteam Boiler we purchased from you," states C. W. Gearner, owner of Texas Creosoting Pole & Post, shown here with his Model AA Amesteam Generator, operating on \$285 fuel cost per month as against \$910 with the former boiler.

SAVING \$625.00 A MONTH ON FUEL

...WITH THE NEW MODEL AA

AMESTEAM GENERATOR

You can't argue with figures. This dramatic fuel saving enjoyed by *Texas Creosoting Pole & Post Co.* by switching to Amesteam Generator amply illustrates our claim of "lower operating costs" for the new Model AA Amesteam Generator. As owner C. W. Gearner states, "...we were using a 110 HP oil field type boiler, and our fuel cost was approximately \$910.00 a month. The

fuel cost on the Amesteam is approximately \$285.00 monthly." Mr. Gearner estimates that the *fuel savings alone* will pay for the unit in twenty months!

If you are interested in fuel economy like this — and economies all down the line — in short, *lower cost steam* — you'll want to mail the coupon below and find all about this totally new Amesteam Generator!

AMES IRON WORKS INC.
OSWEGO, NEW YORK

AMES IRON WORKS • Box P-50, Oswego, N. Y.

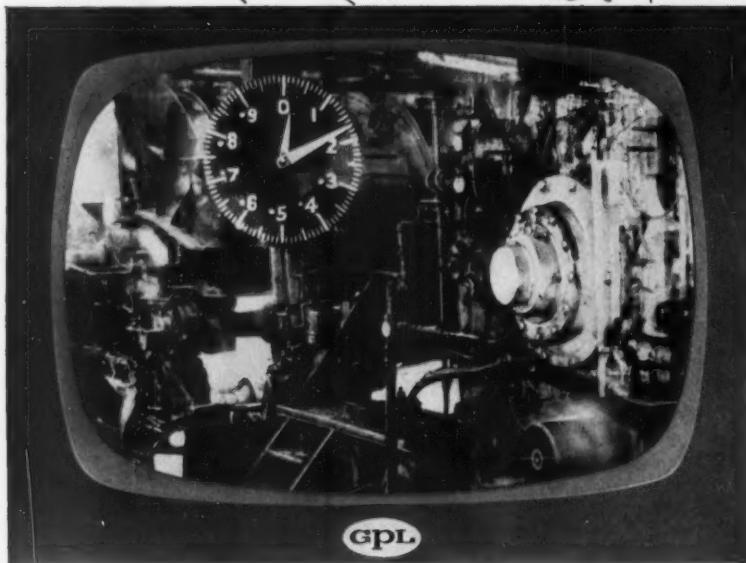
Gentlemen:— Please send me further information on AMESTEAM GENERATORS and name of nearest representative.

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Architects' Problems

Ralph Walker, of Voorhees, Walker, Smith, Smith & Haines, reported on some of the problems of the architect:

"There is a strange quirk in everybody's mind that a new building should somehow or other take care of itself, with the result that suddenly the maintenance engineer is confronted with a sizable amount of work to be done.

"My theme is — no matter how well you build, and there is no reason why you should not build as well as you can — that you will have to maintain buildings in repair from the moment they are built; for the weather is no respecter of architects, engineers, or owners, and the heat expands, the cold contracts, and the dirt of our modern society throws its film of grease and dust over smooth and textured surfaces alike."

Would better building standards help the architect and the engineer in designing for better maintenance? Walker thinks standards sometimes are misused by people who "think a standard is so precious that it will last forever . . .

"We had one such standard in review, one which had been developed at the beginning of the century and caused one stumble after another — a raised toilet room floor, raised just one step above the floor level to which it was attached. It was not only costly but stupid, especially so where the high ceiling of the normal (office building) permitted the use of the hung ceiling. In changing this, instead of a relatively small area of tile surface and an enormous amount of plaster walls requiring constant repainting, we retained the same

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amount of tile surface with only a ceiling to be painted because the ceiling was just above the tile."

Speaking of clients, Walker said, "I like clients who are engineers, largely because of the fact that the experiences of the architect and engineer are quite similar in character. Also, if I may say so, God defend me from a client who is building for the first time."

Charles F. Dalton, vice president of John Lowry Inc., put in a word

for the contractors and their problems. He particularly had a plea to those who select contractors:

"Plans and specifications can be issued to the contractors promiscuously and anyone who cares to can figure the job. This usually results in a long list of bidders and you take the risk of getting either an inexperienced contractor or one who has made an estimating error.

"The second method is to have a selected list of qualified contrac-

tors agreed upon by the architect and owner from whom bids are taken, based on completed plans and specifications.

"A third method of selecting a contractor is on a negotiated basis. With this method the contractor is made a part of the team of owner, architect, [consulting engineer] and contractor, and becomes a responsible party in making major decisions. He can and should sit in with the architect on the selection of materials and the development of costs. A negotiated contract can be awarded on a lump sum, fixed fee, or percentage basis . . . whichever is best for the particular building involved."

Dalton also pointed out that good contractors welcome competent supervision and inspection. But "confusion caused by the overlapping of inspection responsibility is one of the most expensive of the hidden costs in any building, as it adds nothing but cost."

The Future of Air Conditioning

Finn J. Larsen, of Minneapolis-Honeywell Regulator Company, told of a simulated 30-day space flight for two men being planned by his firm. He also had some ideas about air conditioning:

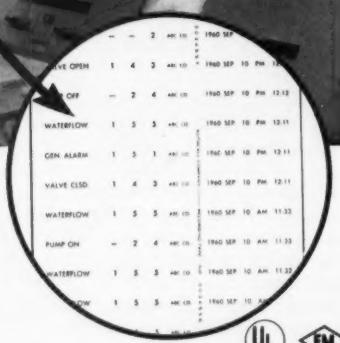
"Have we reached the golden age of comfort? Can we go even further in controlling our environment? Many research scientists believe that we are just beginning to have insight into some very interesting possibilities. For example—a few years ago experiments conducted at a California university indicated that the presence of negative ions in the air made a class of students learn faster than their normal rate. They not only learned more rapidly but seemed to feel better. Other experiments have reported that healing after surgery or recovery from disease occurs more rapidly in an atmosphere which includes negative ions. Unfortunately, these experiments, while interesting, are not regarded as conclusive." □



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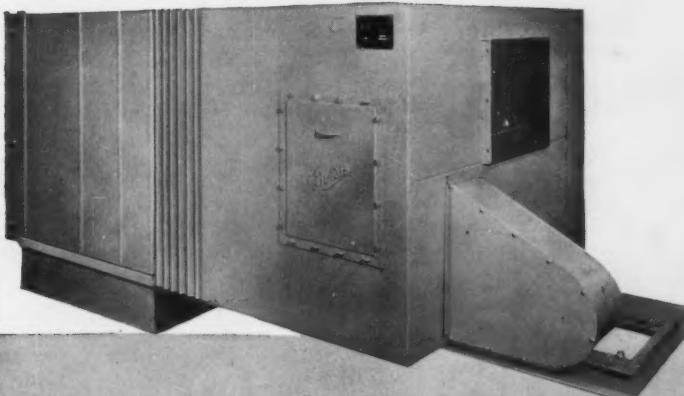
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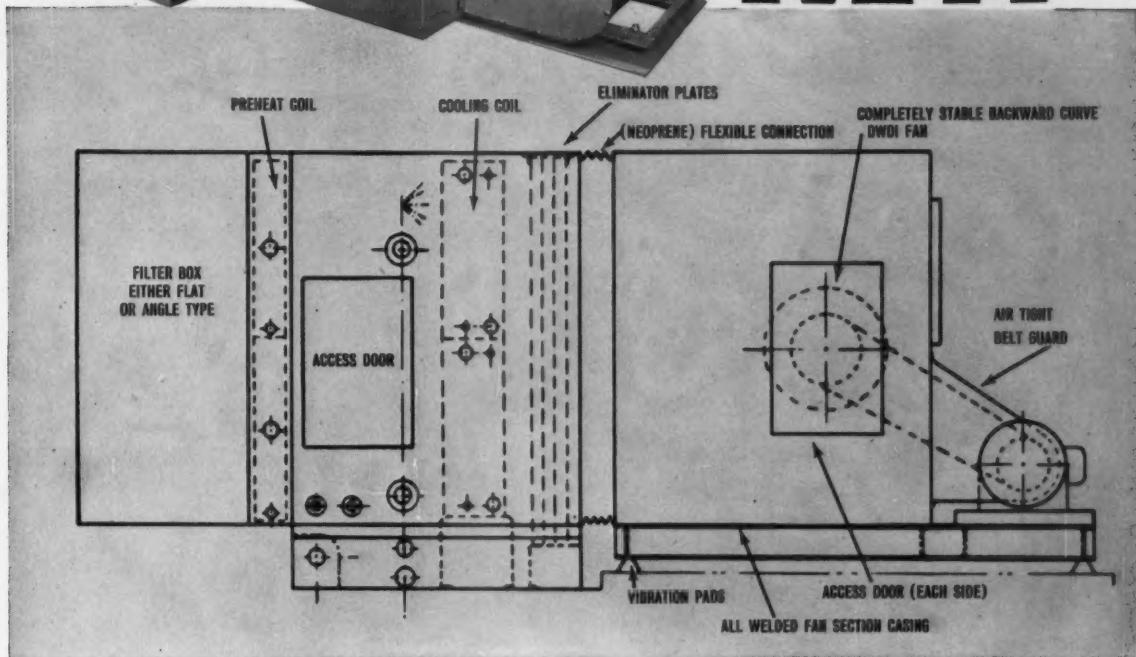
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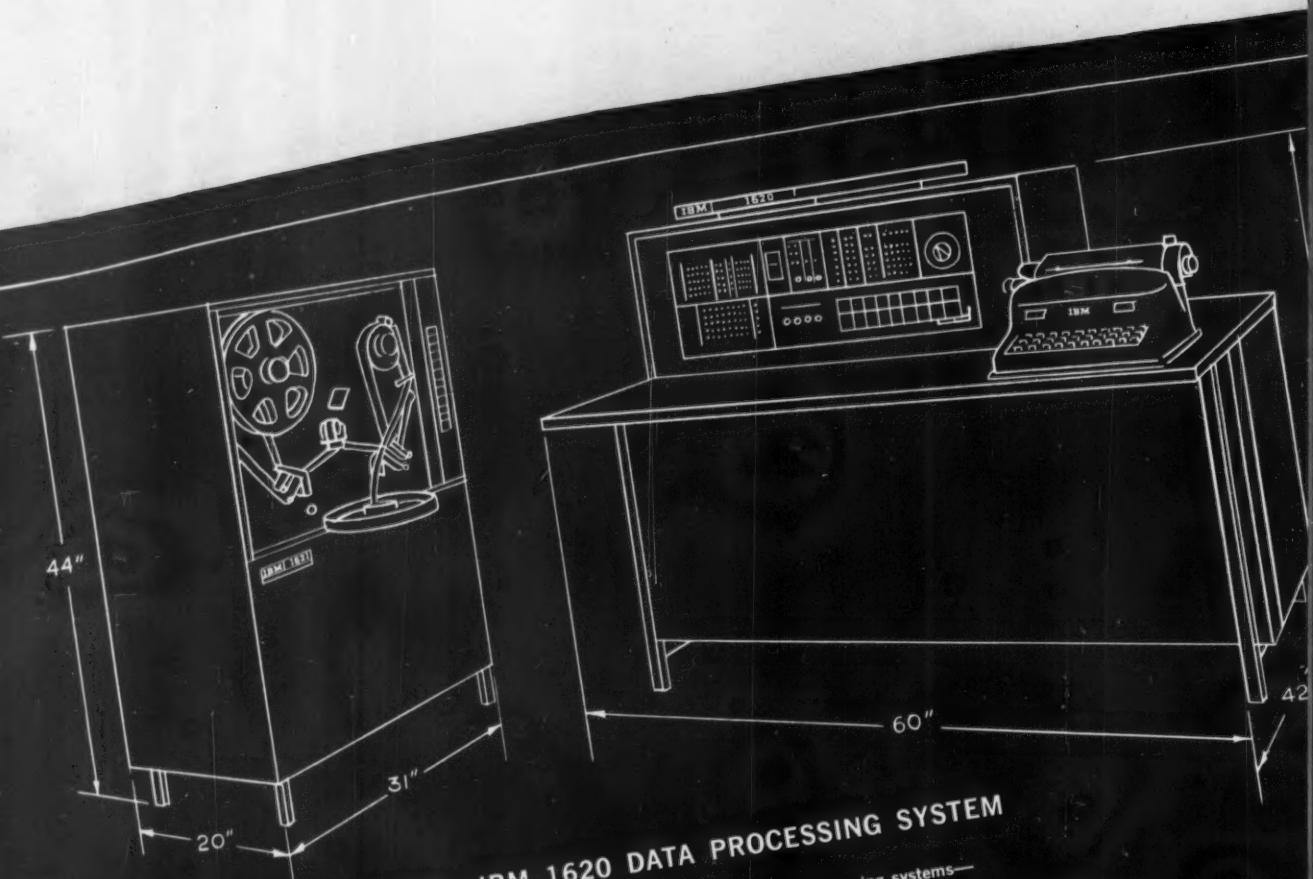


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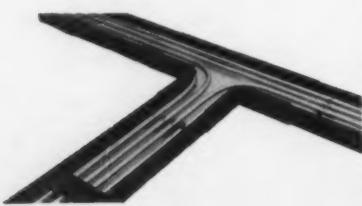
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The Model Law

Revision Proposal

W. M. SPANN, Chairman
Committee on Model Law Revision, NCSBEE

REGISTRATION, or the licensing by law of engineers, was begun in 1907 to combat unscrupulous and incompetent practitioners. To aid in the preparation of such laws, the first edition of a Model Law was issued in 1911. Since that time several revisions have been made, the last in 1946. Many states made use of the Model Law as a guide. However, many of the basic principles suggested were changed so that reciprocal practices are variable and sometimes difficult. Much progress has been made in reciprocal practices through discussions and agreements at meetings of the National Council of State Boards of Engineering Examiners. Since it is not possible to have a Federal Registration for general practice, some unification of basic practices and procedures seems desirable.

The National Council of State Boards of Engineering Examiners appointed a committee at its Milwaukee meeting in 1956 to study the existing Model Law and compare it with the laws now in use. The committee has been actively engaged in this study since its appointment and has received many excellent suggestions.

A meeting was held in Columbia, South Carolina, on March 11 and 12, 1960, with full attendance of the members and legal advisors. Consideration was given to all suggestions, basing acceptance or rejection on the national rather than the individual point of view. Accepting better procedures, preferable to those presently in existence, and attempting at the same time to set up a basic plan of guid-

ance to the autonomous boards without unnecessary details, direction, or wording was extremely difficult. Effort was made to convey basic ideas for uniform regulatory factors without regimentation.

The Model Law is good as it is now. It has served a remarkable purpose in helping many states and territories to develop a satisfactory and workable law. The purpose now is to stimulate uniformly acceptable practices and procedures, so that an engineer may cross state lines under similar qualification regulations.

There is a real need for the establishment of basic principles of equivalence by the several boards. In this spirit, the committee has proposed a set of rules, compiled from the data presented to it. The document has been issued for discussion at the spring Zone meetings of the National Council of State Boards of Engineering Examiners to be held in April and May at Savannah, Columbus, New York, and Laramie; and at a meeting to be held May 16, 1960, in New York, to which representatives of professional groups have been invited for an informal discussion.

The committee then will prepare its report for action by the Council, August 18 to 20, in Portland, Oregon. After adoption by the Council, the Model Law, as revised, will be sent to each professional group for its consideration, approval, and adoption.

The document as revised is complete in itself, although only parts of it are essential to interstate



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registration. Other sections are included to suggest procedures where improvements to existing laws may be desirable. Local conditions make certain items mandatory in one area, even though not necessary in others. For example, a structural engineer on the West Coast must be familiar with earthquake design, though the East Coast need have no such requirement.

Competence Is Important

The competence of the individual to practice engineering is the prin-

cipal factor in a qualifying requirement. The law is not important unless it can be enforced. The incompetent should be eliminated, including those improperly registered through grandfather clauses. With proper regulation of the profession, the seal will be the acceptable stamp of proficiency in the practice of engineering.

Points of interest in the proposed revision include the injunction provision to prevent the practice of nonregistered engineers; and the provision covering the

practice of individuals through the medium of groups, associations, partnerships, and corporations. One controversial issue concerns the land surveyor. The proposed law recommends that the regulation of the practice of surveying be covered by separate laws but under the administration of one board.

The legal reason for the registration and regulation of the engineering profession is the same in all cases — to safeguard life, health, and property.

Registration Statistics

The Proceedings of the National Council of State Boards of Engineering Examiners of 1959 indicate a total of 261,029 registrants in good standing, of which 234,183 are professional engineers, 14,096 are professional engineers and land surveyors, and 12,750 are land surveyors only. Under the laws as now administered, only consulting engineers are required to be registered. Engineers may be classified under four general categories: private practice, government agencies, industry, and education.

This wide variation of interests naturally creates many different ideas which need to be unified or coordinated by registration procedures. It would seem logical that all engineers of all categories, where responsibility is required, should be registered as qualified engineers. Registration thus can be of service in promoting professional unity, in addition to protecting the public.

While each group in the profession has its own technical and individual interests, there is a real need for teamwork and unselfish effort in the advancement of the welfare of all engineers. To this end, the Committee on Revision of the Model Law (NCSBEE) has endeavored, in its report on the revision, to suggest and encourage procedures for reciprocity among the several states in the practice of engineering. ▲▲

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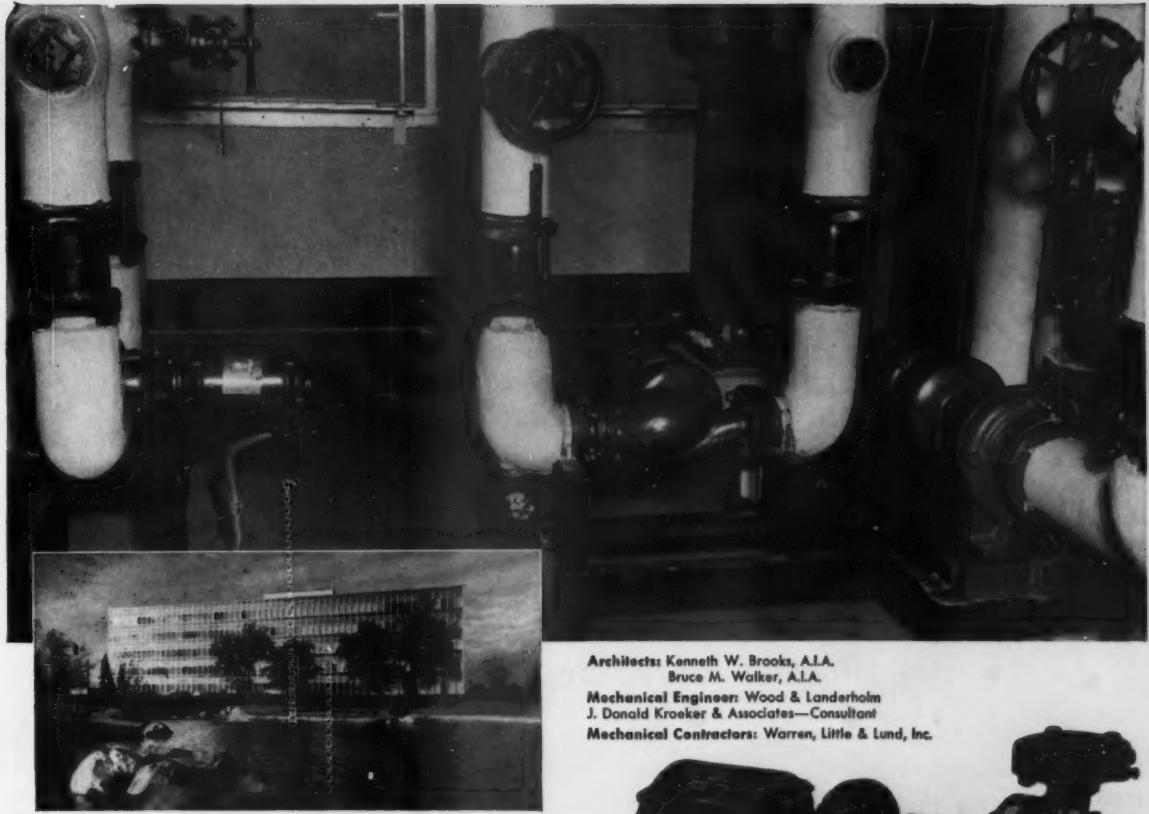
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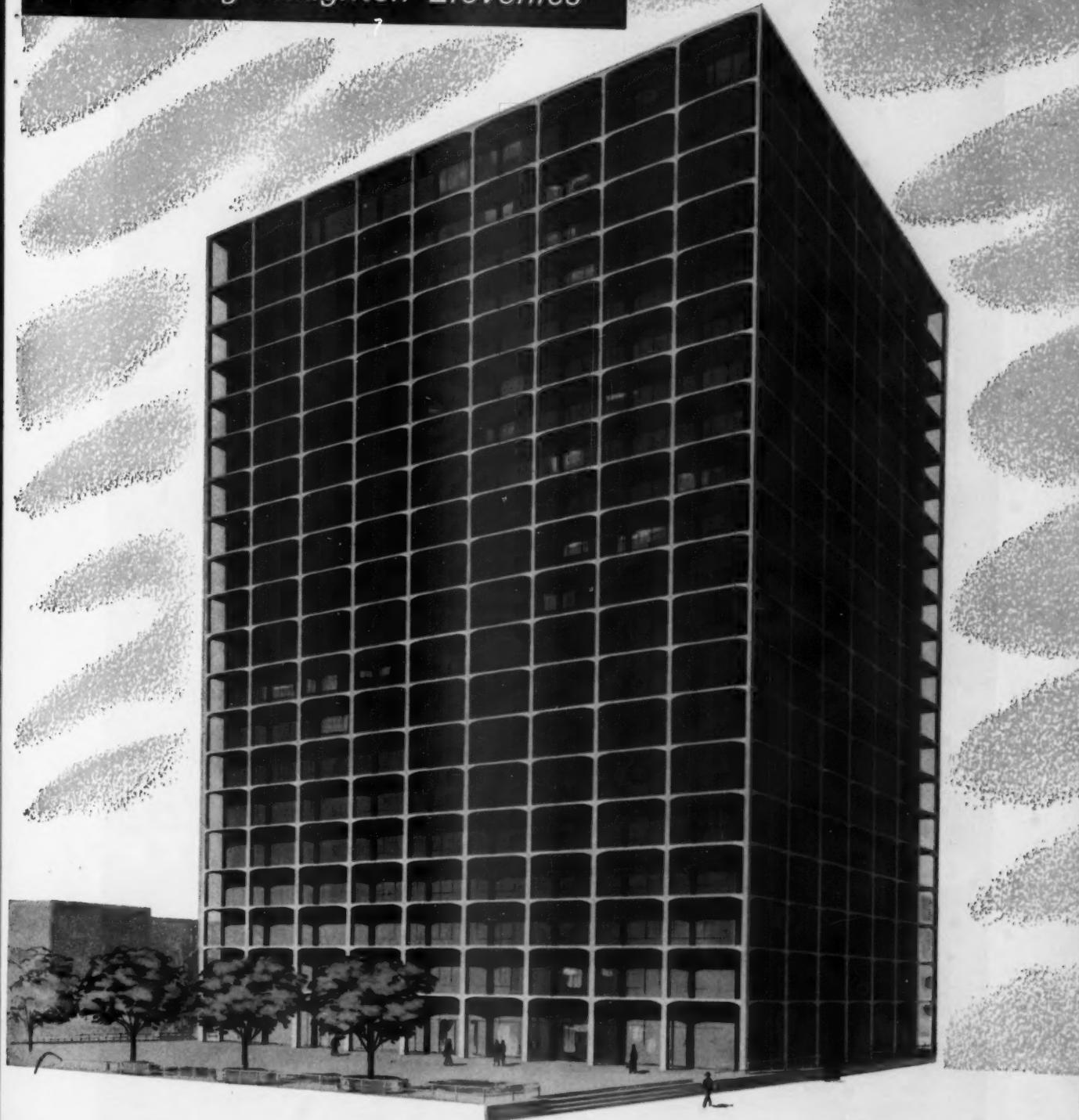


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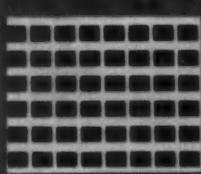
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The Word From Washington



EDGAR A. POE, Consulting Engineer Correspondent

RALPH M. WESTCOTT, a consulting engineer from Los Angeles, appeared before the House Appropriations Subcommittee on Public Works as the retiring president of the Consulting Engineers Council. Representative Louis C. Rabaut, Democrat of Michigan, presided at the executive session.

Westcott said the Council is a national organization representing 28 state-wide associations and 1500 firms. Some of the members are small, operating on an individual basis; some large, employing up to 500 engineers and technicians.

In his prepared statement to the Subcommittee, Westcott said, "We asked to appear before your committee for two reasons, the most important being a paragraph on page 3 of last year's report No. 424 accompanying the Public Works appropriations bill for the fiscal year 1960. That report questions the use of consulting engineers.

"My main concern about this report is twofold. First, I am very much afraid that if the philosophy of using private engineering firms is eliminated by the various departments having problems to do with engineering and design of engineering projects, it will lead to a complete destruction of a segment of the free enterprise system. In the second place . . . it may well lead to greatly increased costs to the American taxpayer.

"Our profession represents a great reservoir of engineering

strength upon which the nation has twice called within the last two decades to do important work in time of emergency. As a matter of fact, the growth of the profession itself can be attributed to the fact that we were called upon during World War II and again during the Korean conflict to provide design and engineering know-how which was not adequately available within the government itself."

Westcott further testified, "There has been a growing tendency in recent years for every agency — municipal, state, and Federal — to increase its engineering staffs. Many of these increases have not been necessary except to handle specific

problems or temporary peak demands. As this committee knows, however, once such increases are made, it is extremely difficult to get the new engineers off the civil service payroll. They are kept on, sometimes doing little or nothing, until the next problem or peak demand arises.

"On the other hand, a private consulting firm hires its manpower as it is needed. In Los Angeles, for instance, we have an engineering manpower pool, and many of our assistants travel from one firm to another as the need arises. The government does not have this flexibility of organization. We also have a flexibility of ideas that will be lost



Representative Ben F. Jensen, Leonard K. Crawford, and Ralph M. Westcott discuss testimony given to House Appropriations Subcommittee.



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if all public works engineering is turned over to the various agencies involved."

Westcott said that in a reply to criticism by the General Accounting Office, Bertram Tallamy of the Bureau of Public Roads had pointed out that one of the best effects of hiring outside consultants was the new life they breathed into the various highway departments through contact with new ideas, innovations, and techniques.

Westcott continued his testifying by telling the House Subcommittee that any engineering staff tends to reflect the ability, ingenuity, and thinking of the man who heads it. In the area of a private consulting firm, "we can stay in business only if the man at the head is receptive to new ideas and new ways of saving money while doing a top job."

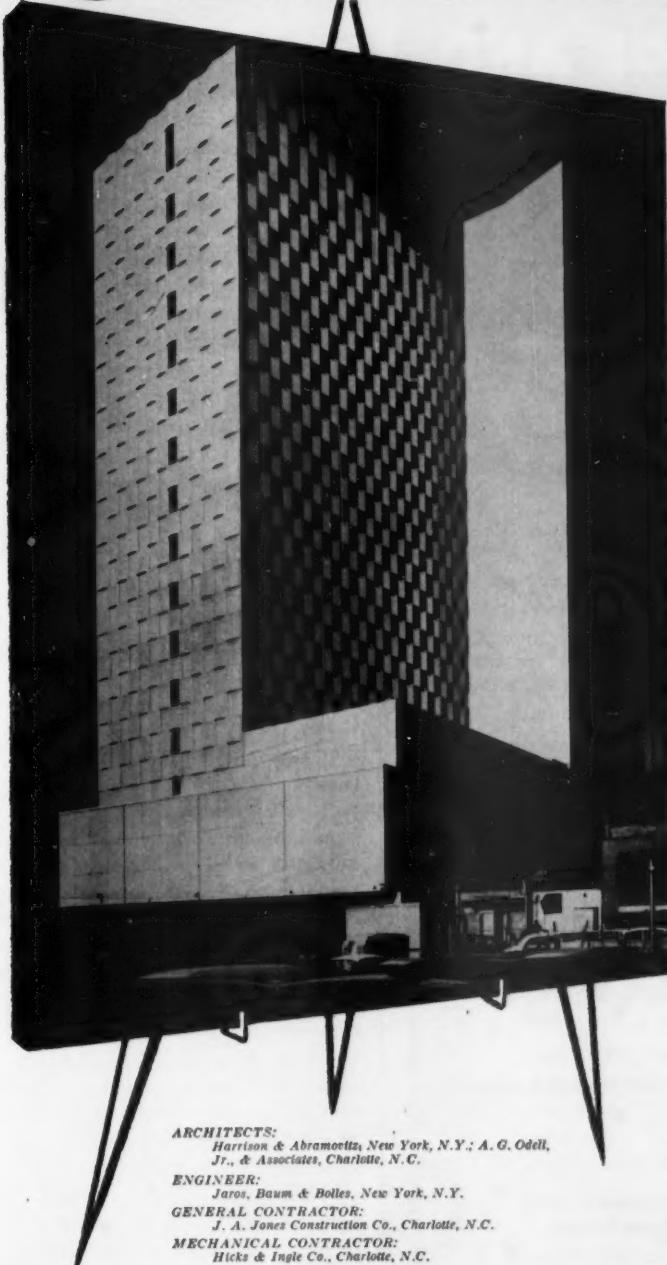
He maintained that a government engineering staff has the tendency to become routine in its thinking and avoid new concepts until they are thoroughly proven outside of the government agency. He added that the competitive challenge to adopt new concepts does not exist in government.

BPR to GAO

The vast national highway construction program got off to a quick start after the 1956 Highway Act only because consulting engineers helped to expedite the program. As a matter of fact, the program could not have gotten off the ground in many states if consulting engineers had not been utilized.

So declared the Bureau of Public Roads, the Federal agency which coordinates and helps to direct the Federal-aid program in the various states. The Bureau's emphatic statement favoring utilization of consulting engineers was in reply to criticism by the General Accounting Office, Uncle Sam's bookkeeping and auditing department. Last year GAO was critical of the use of consulting engineers by some state highway departments. It maintained that

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CONTRAFLO UPFLO CLARIFIERS—Pictures and describes five basic Contraflo types for water softening and clarification. Explains application for industrial waste neutralization and recovery processes.

"CR" ZEOLITE SOFTENERS—Illustrates design and construction details of ion-exchange softeners for hardness removal; tells how to select proper units. Explains various types of regeneration equipment.

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widespread use of consulting engineers increases the cost of building highways. The Bureau of Roads says the contention is groundless.

Excerpts from the reply of the BPR to GAO follow:

"With respect to preliminary engineering, the Bureau considers that the reasons for approval of contracts with private engineering organizations fit the qualifications of the Federal-aid regulations . . . We agree that many States make use of consulting engineering firms to accomplish design.

"However, in numbers of engineering contracts approved by the Bureau in calendar year 1958, records indicate a decrease of 24 percent over the number approved in calendar year 1957. Reports for 1959 indicate a continuation of this trend.

"It should be pointed out, however, that work under the Federal-Aid Highway Act of 1956 could not have gotten off the ground if consulting engineers had not been utilized in many States.

"We do not agree that the use of consulting engineers has increased costs. In many instances it has made available to highway departments experts in various phases of highway engineering, particularly in urban areas, that would be impossible to otherwise obtain. This has resulted in better engineering which increases the value of the dollars invested in the actual construction.

"Public roads will continue to require the States to have adequate highway departments. There must be good progress in the development of plans so that load time required for the orderly acquisition of right-of-way in advance of construction can be provided.

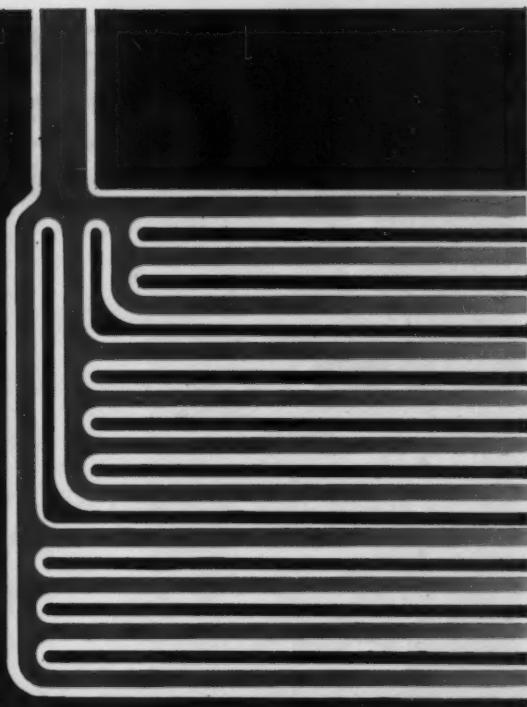
"The use of private engineering organizations to help the States build up this shelf of plans ahead of their construction program will result in more orderly and better right-of-way acquisitions.

"We cannot agree with the statement that there exists generally a

NEW MULTI-ZONE

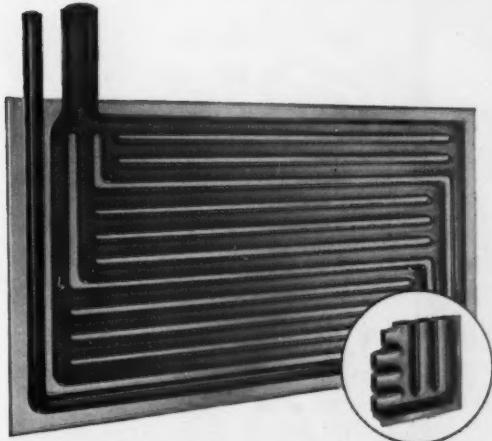
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Better steam distribution provides a reserve capacity for heat transfer to overcome overload conditions which drop tank and process vessel temperatures. Heat-up time after tank or processing equipment shut-down is cut to a minimum. Tank temperatures are maintained within closer limits and production is improved.

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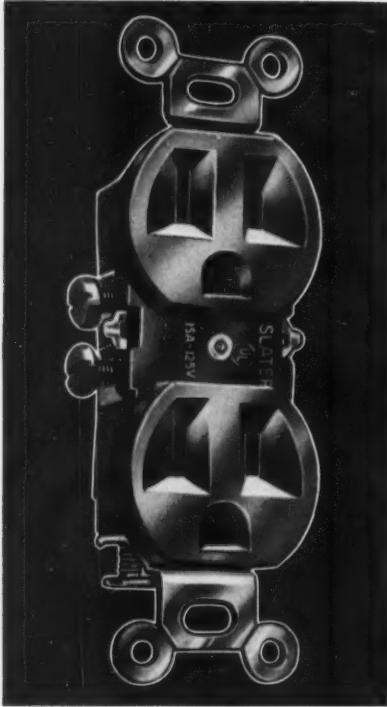


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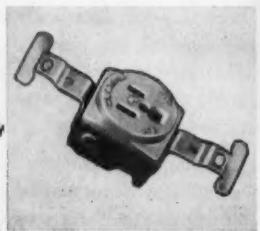
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QUIET
SWITCHES
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'lack of compatibility of existing legislation,' because of the use of consulting engineering.

"The use of consulting engineers for some of the work gives the States greater flexibility; enables them to secure experts for specialized problems, particularly in urban areas; brings fresh, unbiased thinking into solving problems; creates incentive for better production of the States' forces by providing a yardstick of accomplishment; and enables work to be accomplished that would be impossible otherwise.

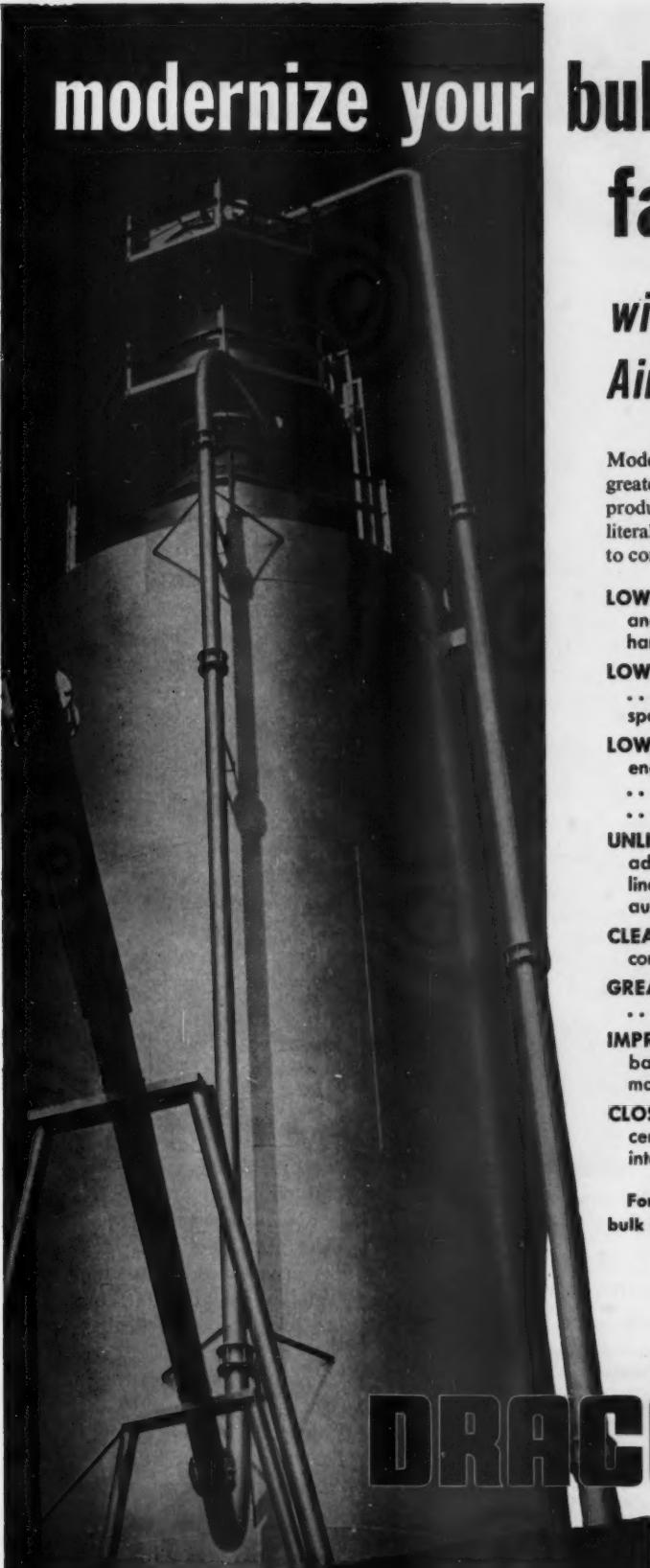
"Public roads has not ignored the use of consulting engineering but has reviewed the problem in cooperation with the States toward getting the job done as efficiently and effectively as possible.

"We believe the use of consultants to get the expanded highway program under way has been beneficial to the States and to the Nation. The States have been able to acquire rights-of-way several years earlier and consequently cheaper than would have been possible under their own design organizations. Also, the earlier completion of Interstate projects, with modern design safety features, has resulted in a tremendous savings in injury and property damage and in life itself."

Post Office Report

There are only 2000 mail trains now used daily for transporting the mail as compared with 10,000 trains 30 years ago, the Post Office Department reports. At least 87 main line mail carrying trains will be discontinued during the first six months of this year. A total of 143 were discontinued in 1959.

Because of the dwindling number of mail carrying trains, the Post Office Department is planning to move more and more mail by airplane and truck. Postal officials say they are planning to move 40,000 tons of first class mail by air, about 15,000 tons more than last year on a space available basis.



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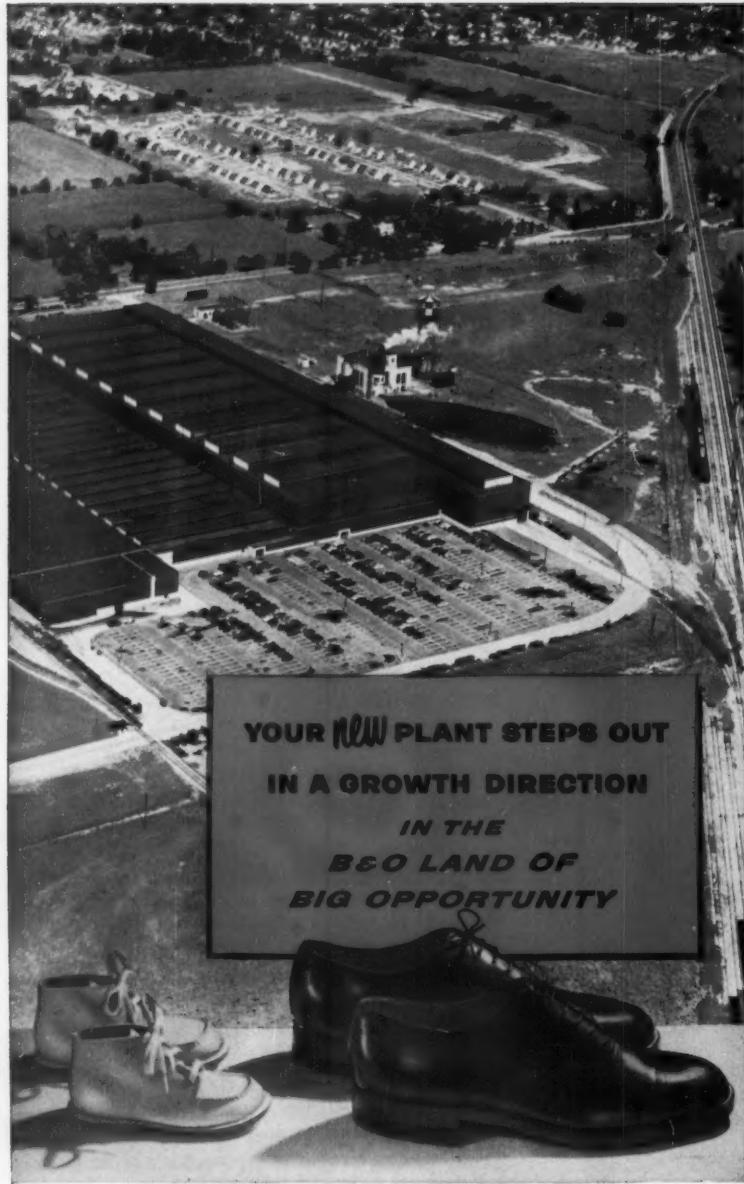
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This would mean that one out of every four first class letters would go by air, in addition to the regular air mail.

U. S. Stake in Venezuela

Total United States investment in Venezuela is placed at \$2,683,000,000, according to estimates made in the Latin American country. The amount is greater than any other country except Canada. A substantial portion of United States investments in Venezuela involve the petroleum industry. Venezuela's oil production in 1959 was approximately one billion barrels or about 16 percent of the world production.

Better Machinery Aids Engineers

H. A. Radzikowski, chief of the development division, Bureau of Public Roads, declares that highway and consulting engineers have a stake in the growing improvement of construction machinery. This means lower unit costs, an accelerated rate of construction, and better quality of a completed highway.

The BPR engineer, peering into the future of equipment developments, saw several things. For instance, a new nuclear device may provide a much quicker way of determining density and moisture content in the field. If this development is perfected, it would mean further construction economies, and a better quality highway link.

States Rights

A committee of governors and Federal officials in a joint report to the White House and the National Governors Conference emphasizes the need for state attention to urban renewal and other metropolitan problems. The final report of the Joint Federal-State Action Committee was submitted to President Eisenhower and Governor J. Caleb Boggs of Delaware. It specifically recommends that each state create an agency responsible for urban renewal and metropolitan

Sewage Pump Well Elevation Held at 114.5'±3" Despite Big Variations in Flow



Three of four E-M 200 hp, 1200 rpm Vertical Synchronous Motors with Adjustable-Speed Magnetic Drives at Nut Island Sewage Treatment Plant of the South Metropolitan Sewage System in Quincy, Massachusetts

E-M Vertical Synchronous Motor and Magnetic Drive Unit for adjustable-speed power transmission to vertical centrifugal pump. The ring element (1) mounted directly on the motor shaft turns at motor speed. The magnet element (2), mounted

inside the ring element, has no mechanical connection to the motor . . . torque is transmitted through magnetic flux linkage between ring and magnet. By varying amount of excitation to magnet, pump speed can be precisely controlled.

AMAZINGLY PRECISE CONTROL OF SEWAGE PUMPS OBTAINED WITH E-M ADJUSTABLE-SPEED MAGNETIC DRIVES

One of the critical problems in operating Boston's new Nut Island Sewage Treatment Plant is complete control over the wide daily, weekly or seasonal flow variations. For example, flows may vary from 63 mgd to 249 mgd, with peak loads of nearly 300 mgd during stormy periods.

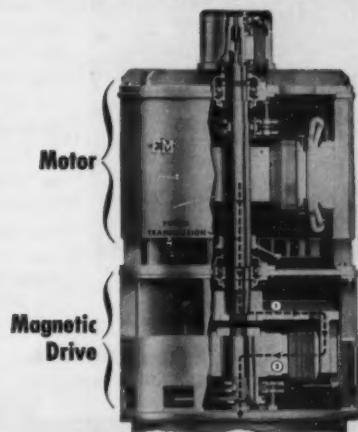
The pump well has to maintain an elevation of 114.5 feet with not more than 3 inches variation, to assure proper levels and flow velocities in the sewage processing channels. Control of the output of the low-lift sewage pumps has to be fast and remarkably accurate.

Use of E-M Adjustable-Speed Magnetic Drives for the low-lift pumps provides the sensitive speed control necessary in maintaining this close command of the pump well elevation.

Pump speed changes are dictated by a well float that actuates the Magnetic Drive through an E-M "Regutron" Control. Pump speed is automatically increased or decreased to maintain precisely the required pump well elevation. The Magnetic Drives are highly important and effective factors in most efficient operation of the Nut Island Sewage Treatment Plant for eliminating pollution in Boston Harbor.

For more information, see your nearest E-M sales engineer. And write direct for a copy of E-M Synchronizer No. 38 which tells the complete story of this outstanding installation.

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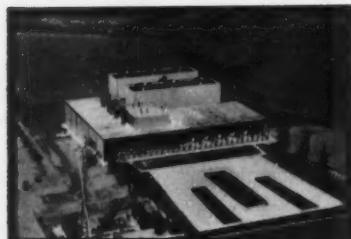
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Central Heating and Refrigeration Plant
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These four LFW-20 International-LaMont Generators have a combined capacity of 160,000,000 Btu/hr.

The unmatched economies of high temperature water are realized throughout the year at New York International Airport. In addition to heating the vast Terminal City, HTW (380° F. at outlet) produced by four International-LaMont Generators feeds nine absorption machines in the unique Central Heating and Refrigeration Plant—the first of its type. Visit it next time you stop at Idlewild.

International Airport is only one of the major HTW installations both here and abroad. To date, more than 130 International-LaMont High Temperature Water Generators are in operation with total capacity exceeding THREE BILLION Btu/hr. All of these employ the proven LaMont principles of forced recirculation which permit temperature differential to 200° F. or more with no danger of thermal shock—the key to truly significant economies.

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planning, and take over such functions, financial and otherwise, from the Federal government as soon as possible.

In an earlier report the joint committee proposed transfer of both financial and administrative responsibility for the vocational education and waste treatment construction grant-in-aid programs from the Federal government to the states. To aid the states in financing these responsibilities, the committee recommended changes in the Federal tax on local telephone service be changed so as to provide a tax credit to states enacting a 4 percent local telephone tax.

South American Loans

Mexico's national income has been increasing in recent years at a faster clip than its 1 million a year population growth, the World Bank reports. The Bank has lent a total of \$186 million to finance expansion of the economy. More than \$125 million has been lent to assist in the installation of new electric power plants, which are needed for both industry and the extensive irrigation that is transforming the Mexican agriculture.

The World Bank also reports that of the \$106,000,000 Chile has borrowed from it, \$61 million has been for power facilities, \$21.8 million to modernize and expand two coal mines, and \$20 million to help finance construction of a paper mill.

In Uruguay about \$64 million in loans has been made for the electric power needs for industrial expansion. In the Central American countries of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama, the Bank thus far has loaned almost \$100 million—primarily for highways, with power loans running second in importance.

Mushrooming Red China

A top State Department planner expresses the conviction that within 10 years China will be as strong or stronger a nation as Russia was

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I-T-E URELITE individually enclosed large air circuit breakers. Available up to 600 v a-c, 15-4000 amp continuous, up to 150,000 amp interrupting.

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I-T-E CIRCUIT BREAKER COMPANY

at the outset of World War II. James W. Riddleberger, foreign aid chief, declares that the Chinese Reds are expanding both their economic and military strength at rates that approach the fantastic. By 1970 China may well be ahead of the USSR, he avers.

As an outgrowth of the rising strength in China, the Eisenhower Administration is asking Congress to vote \$724 million to be spent in the next fiscal year to bolster

the governments of 12 Eastern nations of neighboring China. The State Department spokesmen believe that by spending the funds the U. S. can delay the taking over of these countries by China.

Foreign aid, despite the opposition, appears likely to continue for years and years, if not forever.

More Highway Testimony

Appearing on behalf of the American Road Builders' Association be-

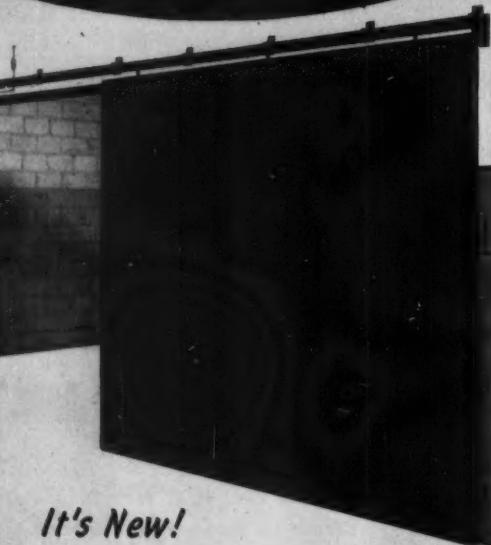
fore the House Public Works Committee, Harold L. Plummer of Madison, Wisconsin, a partner in a firm offering consulting services in the highway management field, said:

"Our membership is representative of the entire highway industry and the highway engineering profession. Our 7000 members include contractors, manufacturers and distributors of highway construction equipment; material suppliers; faculty members and students of the leading colleges and universities offering instruction in highway engineering; Federal, state, county, and municipal highway officials and engineers; consulting engineers; and commercial and investment bankers."

Declaring that tremendous progress has been made since the accelerated highway program began in 1956, Plummer added, "The records show that the highway industry, including manufacturers, suppliers, highway contractors, and consulting engineers, have done a remarkable job of cooperating with the engineers and administrators to deliver full dollar value to the public."

The Badger State consultant cited a series of things he said has made it possible to hold down highway construction costs in a period of general price increases. More efficient equipment and improved construction methods have resulted in great strides for the highway building industry. These include improvements in paving machinery and paving methods, and improved techniques in earth-work compaction.

Furthermore, he testified that the door has been opened by engineers on a vast new field of technological improvement based on the utilization of electronics. Electronic devices can be used on scrapers, for example, to permit greater accuracy in the work performed with this type of equipment. He declared that electronic computers are coming into wide



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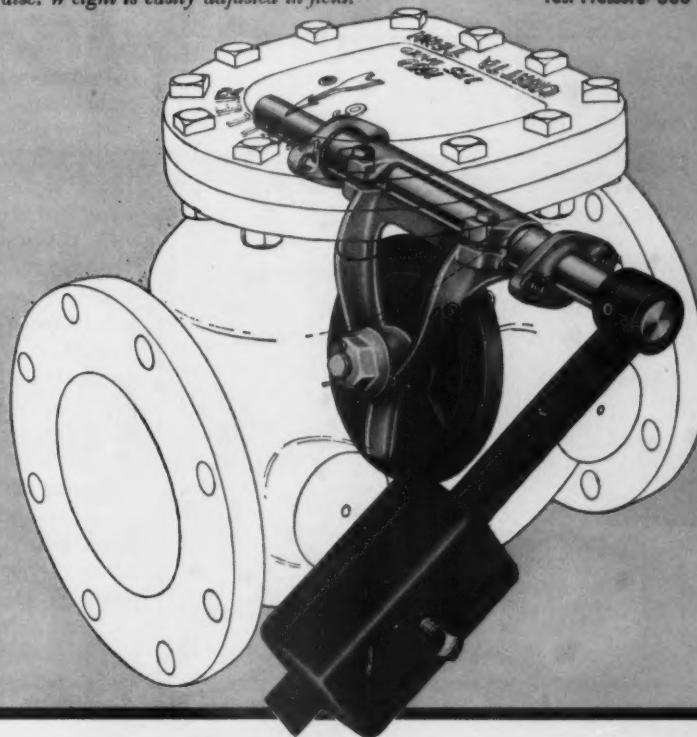
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heavy duty disc assembly that lasts and lasts!

Lever and Weight Type

...ideal for use in pump suction or discharge lines to cushion and reduce slamming and hammering. Lever may be positioned to speed up or slow down closing of disc. Weight is easily adjusted in field.

Iron Body — Fully Bronze Mounted
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Working Pressure: 175 p.s.i.
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All working parts of these new Mueller Swing Type Check Valves are heavily made to assure long service life and dependable operation *without maintenance*.

A heavy stainless steel hinge pin is used on all lever and weight type (shown) and lever and spring type check valves. This pin is extended through the hinge plugs to permit the lever to be used on either side of the body. An "O" ring on the plug prevents leakage around the pin.

The plain type, without lever, weight or spring, uses a new combined hinge pin and plug which is securely and accurately held to the body by studs and

nuts. An "O" ring positively seals the plug to prevent leakage.

Large, wear-resistant bearings and a full-width clapper arm hinge, used in all types, accurately and rigidly align the disc to eliminate chatter and vibration.

These new, heavy duty check valves have been specifically designed for repeated opening and closing applications in water works pumping stations, water filtration plants, sewage treatment plants and general industrial plants. They are suitable for horizontal or vertical installation on water or oil lines.

Write for specifications.

The many exclusive features of these new check valves are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product.



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use as a tool for performing routine engineering computation.

The ARBA spokesman also told the lawmakers that competition among highway contractors has been increasing. The average number of bidders per Federal project was 3.9 in 1946, 5.0 in 1952, 6.7 in 1958, and 7.4 in 1959 (first half).

Labor and the Coming Campaign

There is a marked division of opinion among the country's top drawer

labor leaders in their preference for the Democratic presidential candidates, Senators Hubert M. Humphrey of Minnesota, John F. Kennedy of Massachusetts, and Stuart Symington of Missouri. The labor group could and would go along with former Governor Adlai E. Stevenson of Illinois, should he become the Democratic standard bearer. However, they have reservations about Senator Lyndon B. Johnson of Texas, the Senate ma-

jority leader. Therefore, the plan among the labor chieftains is to remain tight-lipped publicly until after the Democratic National Convention at Los Angeles, which does not get underway officially until almost the middle of July.

At the same time, it is no secret in Washington that the labor bigwigs want no part of Vice President Richard M. Nixon, candidate for the Republican presidential nomination. The cold, hard facts indicate that labor leans heavily toward the Democratic presidential nominee and the entire Democratic slate.

Anti-Smog Campaign Grows

There is growing pressure for legislative action requiring anti-smog devices on internal combustion engines. So far, the pressure is for voluntary installation by manufacturers and operators. Nevertheless, there is an implied threat that if motorists do not install them voluntarily, the government will require them to do so through legislation in the years immediately ahead.

Apparently there will be no legislation passed at this session, but the seeds have been planted. Secretary of Health, Education, and Welfare, Arthur S. Fleming, vows that anti-smog devices should be made standard equipment on automobiles, busses, and trucks. Some Congressmen are urging automotive manufacturers to install new anti-smog devices on the vehicles as they come off the assembly lines, just as they install radios and other accessory equipment.

Manpower Commission

Carl Frey has been named assistant to L. K. Wheelock, executive secretary of the Engineering Manpower Commission. After being given the opportunity to learn the activities of the Commission, Frey is expected to take over as executive secretary. Wheelock recently was named as new secretary of Engineers Joint Council. □

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Why chance the mess of compound leakage? Jefferson has the solution: DRI-LOK, a new ballast with a new thermosetting material, which fills the entire case and permanently bonds case, core and coil into a solid unit. This marvelous new filler cannot combine or react with other material in the ballast; cannot soften or liquefy under any condition of operation. Only DRI-LOK ballasts give you this positive protection.

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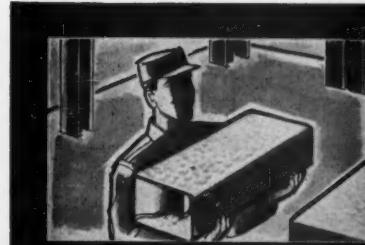
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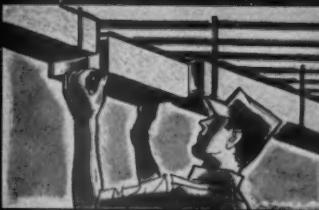
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ways AIRCOUSTAT. can save you time and money

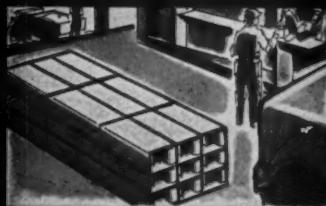
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2) Easy to handle—No riggers or special equipment needed. Large units composed at job site.



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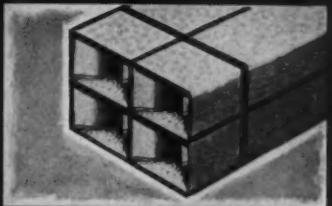
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Pre-engineered by Koppers to eliminate guess-work, unnecessary calculations and difficult installations, AIRCOUSTAT Sound Traps guarantee trouble-free silencing of all duct-transmitted noise . . . at a savings in time and money to you.

AIRCOUSTAT selection is quick, simple and reliable. A choice of over 60 stock models, fabricated in 6 lengths, solves every noise

reduction problem. AIRCOUSTAT is built to give a lifetime of maintenance-free service.

Write today for your copy of the AIRCOUSTAT Selection Manual, a quick guide to the right unit or combination of AIRCOUSTAT units to eliminate duct-transmitted noise in all air handling systems. Write KOPPERS COMPANY, INC., Sound Control Department, 3605 Scott Street, Baltimore 3, Maryland.



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Buss Low Peak fuses can completely revolutionize the protection of the entire electrical system.

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CONCRETE PERFORMANCE REPORT:

POZZOLITH lends 5000 psi concrete high degree of workability in interesting new structure

Phillip Johnson's new Munson-Williams-Proctor Institute Art Gallery in Utica, New York, features a unique structural system. In it, Dr. Lev Zetlin's use of engineering theory and imagination combine to produce a building of outstanding practicality. Many catch-phrase titles have been applied to the prestressed concrete structural system, which Dr. Zetlin himself calls a "two-way lattice girder". Others, after a glance at the huge monolithic system of two parallel pairs of concrete beams which intersect at right angles to form a single monolithic girder, have mentioned its resemblance to a gigantic game of tic-tac-toe.

Actually, the monolithic structural system of cast-in-place, post-tensioned concrete is completely functional, and results in an interior free of supporting columns. The four sections were monolithically cast in one huge concreting operation and are supported only at their extremities. According to Dr. Zetlin's computa-

tions, the resulting single girder provides a strength and rigidity equal to eight similar parallel girders, or sixteen 2' x 2' interior columns.

This huge girder, consisting of four 123'10" sections, was cast-in-place more than fifty feet above grade. Within their 10'9" x 22" cross-section, each of its four sections contains 14 flexible, hollow conduits for the post-tensioning cables, four 4" hollow sleeves for balcony rods and several types of reinforcing bars in diameters up to $\frac{1}{2}$ ".

This complexity of steel, coupled with the need for a continuous placement of concrete to provide a truly monolithic girder, required special considerations in the design of concrete. Dr. Zetlin's structural system required a concrete mix which met these four specifications:

First, 5000 psi compressive strength for economical utilization of prestressed concrete and to meet the prescribed design loads.

Second, to assure a monolithic member completely free of horizontal cold joints and honeycombing, the hardening of the mix had to be retarded.

Third, a high degree of workability was required because of the complexity of steel reinforcement and delicate positioning of conduits within each section.

Fourth, a low unit-water content for minimum shrinkage and over-all improvement of concrete quality.

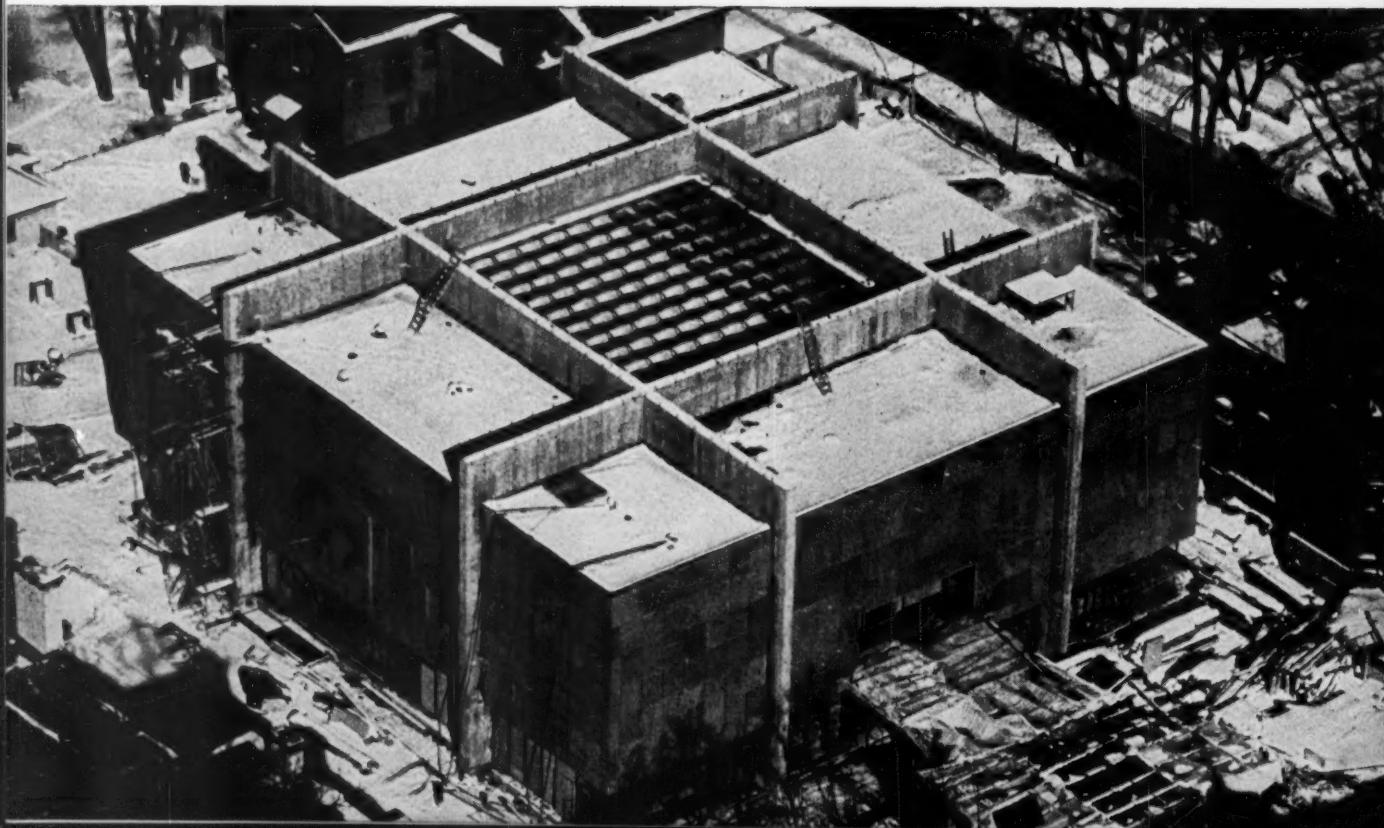
Cooperative effort by the local Pittsburgh Testing Laboratory, the Alpha Portland Cement Company and the local Master Builders field men, developed the following mix design:

Type I Alpha	
Portland Cement—	668 lbs.
Sand—	1240 lbs.
#1 Stone—	550 lbs.
#2 Stone—	1280 lbs.
Water—	32 gals.
Pozzolith Retarder—	1.78 lbs.

The mix had excellent workability and was easily placed with only $3\frac{1}{2}$ " slump. It contained 20% less water than a comparable plain mix. A companion mix with $2\frac{1}{2}$ " slump was also designed for use during later stages of placement to insure equal rate of hardening.

Placing operations began at 8 a.m. with two crews of the George A. Fuller

UTICA ART



Co., General Contractors, New York City, starting at adjacent corners and working across the top of the building. Two cranes supplied the POZZOLITH ready-mixed concrete from the American Hard Wall Plaster Co., Utica, as the crews worked their way across the top of the structure. At 5 p.m., another crew and crane joined in, and shortly after midnight placing was completed. During the 16-hour, continuous concreting operation—approximately 360 cubic yards of concrete were placed in the intricate forms . . . and POZZOLITH helped assure a truly monolithic structure by retarding the hardening of the mix to eliminate cold joints.

Seven-day breaks on test cylinders averaged 4200 psi, 14-day breaks averaged 4985 psi and 28-day breaks averaged 5665 psi. Two weeks later, the girder was post-tensioned by Pre-Stress, Inc., of Albany, employing the P.I. system of anchorage.

POZZOLITH concrete was used throughout this building—from the intricate lattice-work of cast-in-place concrete ribs which spans the central bay, to the massive walls of lightweight concrete which seem to float on a ribbon of glass at grade level. The hung balcony around the perimeter of the interior and its cantilevered reinforced concrete

stairway also contain POZZOLITH.

Utica's Munson-Williams-Proctor Institute Art Gallery stands as a unique and significant engineering achievement, and an example of the great utility and versatility of modern POZZOLITH concrete, one of today's most economical and exciting building materials. It is also evidence of the benefits of close cooperation between creative architects and engineers, and the suppliers and builders who turn their designs into realities.

POZZOLITH and Master Builders Field Service—From early planning through completion of the job, the consulting engineers, contractor and ready-mix producer had the full cooperation of the Master Builders field men. These experienced field men utilized Master Builders technical products and know-how to achieve uniform concrete of superior quality, at lowest cost-in-place.

To better meet concreting requirements on your current and future projects—call in the local Master Builders field man. At no cost, he'll demonstrate—with your materials—how concrete produced with POZZOLITH becomes a more versatile and more useful building material...superior in performance, in quality and in economy to plain concrete or concrete produced with any other admixture.



CONTINUOUS 16-HOUR PLACEMENT OF CONCRETE

To assure a completely monolithic member, all concrete for the girder was placed in a single, continuous operation. POZZOLITH retarded the hardening of the mix during placement, preventing horizontal cold joints.

GALLERY

HUGE PRESTRESSED MONOLITHIC GIRDER—The structural system, weighing 720 tons, and containing over 360 cubic yards of 5000 psi concrete was cast-in-place 50 feet above grade. The girder supports roof and hung balcony without interior columns. Facade will be covered with black Canadian granite, while girders and their supporting columns will be sheathed in bronze.

THE MAZE OF REINFORCING STEEL and 14 flexible conduits for the post-tensioning cables made high workability a must in the concrete mix design. Use of POZZOLITH permitted a sharp reduction in water content, yet gave a highly workable mix with 3½" slump.

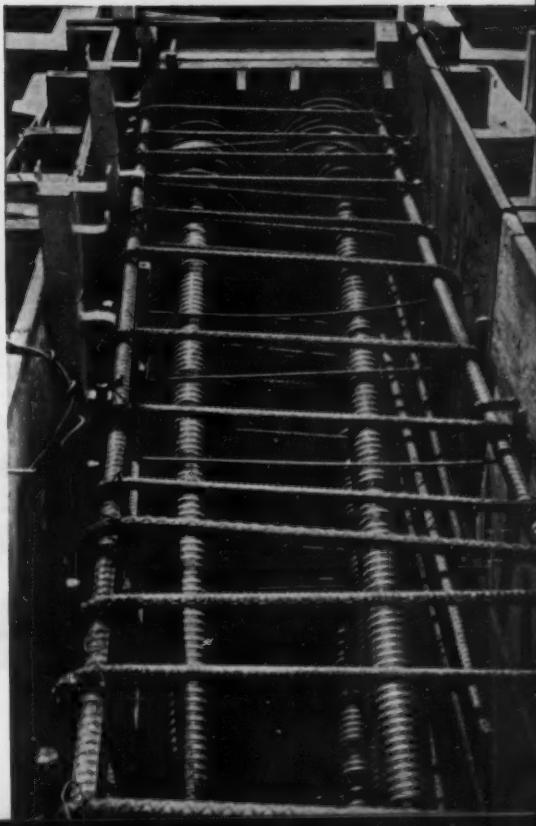
THE MUNSON-WILLIAMS-PROCTOR INSTITUTE ART GALLERY was designed by architect Phillip Johnson and engineered by Dr. Lev Zetlin, both of New York City. Supervising architects were Bice and Baird of Utica. The George A. Fuller Company, New York City, built the art gallery, with Jack Madden as project supervisor and William Gardner as engineer. The American Hard Wall Plaster Company, Utica, supplied the POZZOLITH ready-mix concrete. Pre-cast roof sections were supplied by Schenectady Concrete Products. Post-tensioning was by Pre-Stress, Inc. of Albany.

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Lee's Lecture

The Fallacy of Engineering Science

JOHN F. LEE

Broughton Professor and Head
Department of Mechanical Engineering
North Carolina State College

THE TERM "engineering science" is the most abused combination of words in modern English. Somehow, in the scientific renaissance of the mid-twentieth century, the combination fell pleasingly on the ear and, as a result, was embraced without question.

Meaning Is Confused

To the status-seeking engineer, the phrase implies an alliance with pure science, which he secretly desires in an era of scientific adulation. To the bewildered educator, the phrase offers a mask for mediocrity and a vehicle to avoid meeting responsibilities head on. To the pure scientist, it represents a flattering attempt at mediocre emulation of science — an attempt which he views with a good measure of benign smugness. To the general public and to prospective students of engineering, the phrase "engineering science" has spelled confusion and tacit confirmation that, after all, engineers are no more than second-rate scientists with no real justification for professional existence. But to others, engineers and educators alike, the phrase symbolizes a war cry against die-hard attitudes and last-ditch de-

fenses of obsolete engineering education and practice.

Like most other human activities, education has its share of promoters who thrive on their ability to ride one expediency after another. Some of these promoters are ingenious enough to coin their own catch phrases. Others are merely disciples, with ears finely attuned to the next tinkling cymbal which will call them to a new faith. Rarely do any of these promoters offer sound solutions to problems confronting the profession. More often, they leave a wake of wreckage behind as they hop expediently from one fad to another.

"Burr in the Saddle"

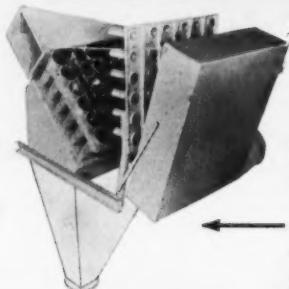
Quite recently, the head of a department of applied mechanics complained with deep emotion about the inability of engineers to design. Of course, neither could he. Nor did he feel he should be able to do so, for he believed that his function was to provide the "burr in the saddle" to his engineering department to inspire the staff and students to do creative design. How this was accomplished, he could not explain. Yet this man has many disciples among edu-

cators who lack the ability to make proper value judgments and, as might be expected, the catch phrase "burr in the saddle" provides an excellent rallying cry.

Jack-Of-All-Trades

Another type of educator is the generalist or jack-of-all-trades. To this man the obvious alternative to narrow specialization is the elimination of all specialization. He purports to have the golden touch by which students are trained to range over the whole spectrum of science with instantaneous and noiseless shifting of gears. This man has "discovered" the simple unity of all science (he never uses that old-hat word "engineering") and is imbued with a clairvoyance that would put an oracle to shame. He fails to realize or admit that his educational program does not bring the students to grips with the realities of engineering and that his poor wandering waifs are not able to hold their own with either engineers or scientists. A large percentage of his graduates eventually crawl back to the womb of the college campus to perpetuate the production of their ilk and to prove the old saw that "those

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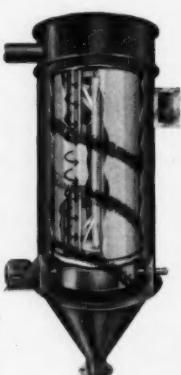


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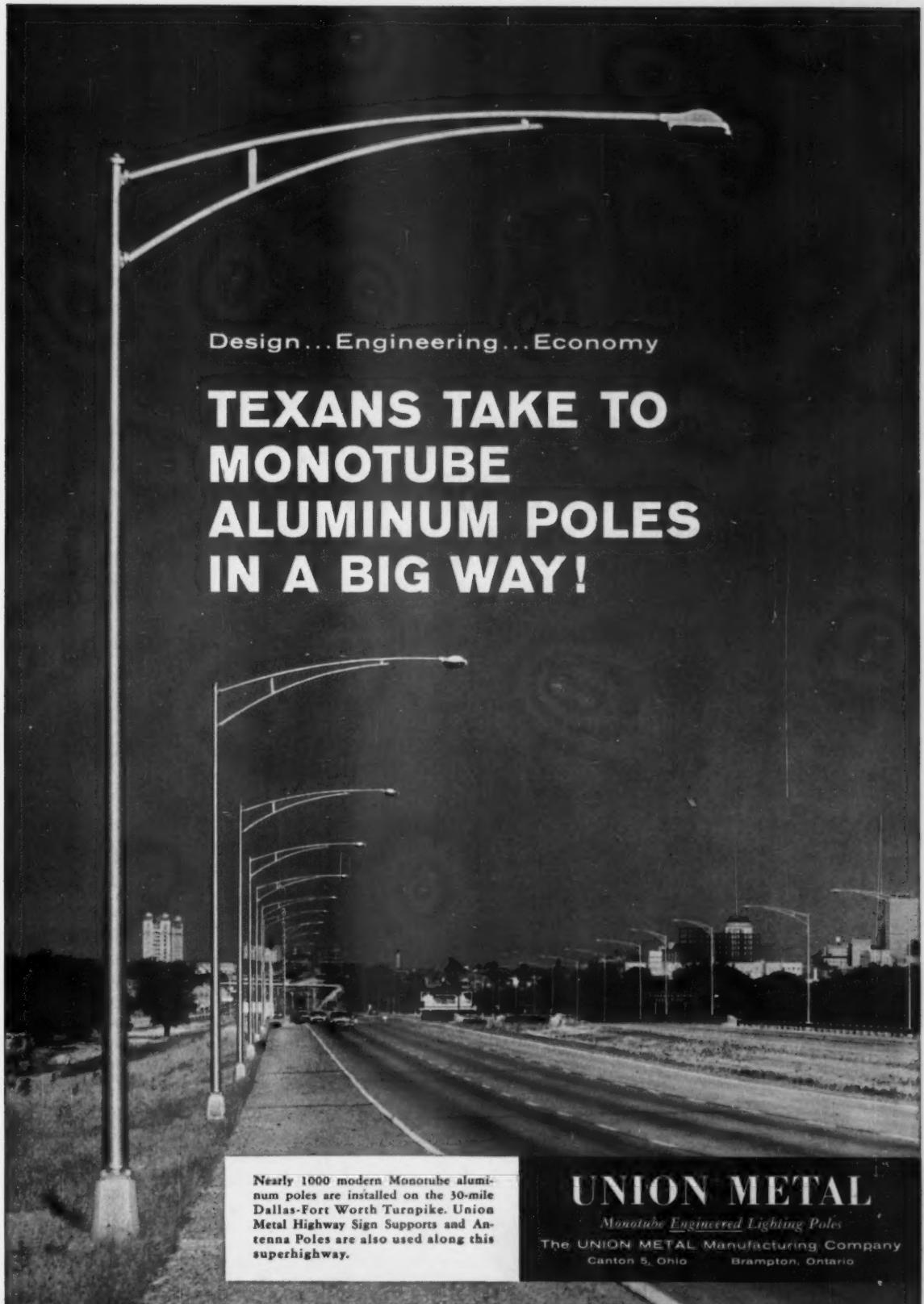
who can, do, and those who cannot, teach."

What many educators forget is the fact that engineers are motivated by a desire to satisfy human needs through the application of science. The engineer must be objective in his understanding of science, but he must be subjective in many of his judgments. Thus, a combination of scientific knowledge, ingenuity, and value judgment are prerequisites to engineering design which is the essence of engineering. A knowledge of pure science and mathematics is necessary, but not sufficient, for successful design. Very few physicists or mathematicians are capable of engineering design. Hence, a scientific education alone can never be a substitute for engineering education. Something important comes between science and design.

Engineering Theory

Science is analytical and objective. Even experimental science is devoted to the proof of conclusions reached analytically or to providing a clue to the evolution of analytical conclusions. A scientific mode of reasoning and a large number of scientific facts are a part of the elementary education of an engineer. Mathematics, as the art of communication by which scientific relationships are conveniently expressed, is also vital to sound engineering education. Once these are mastered, the engineer must develop his knowledge and skill in the synthesis of scientific relationships and facts as a precursor to intelligent design. It is in this area that schools of engineering meet their first responsibility. It is here that an engineering mode of reasoning, with the first insight into synthesis, must be developed clearly if the student is ever to be successful in design.

It is important at this point to avoid the catch phrase "engineering science" and stick to the old fashioned phrase "engineering theory," to describe this area of



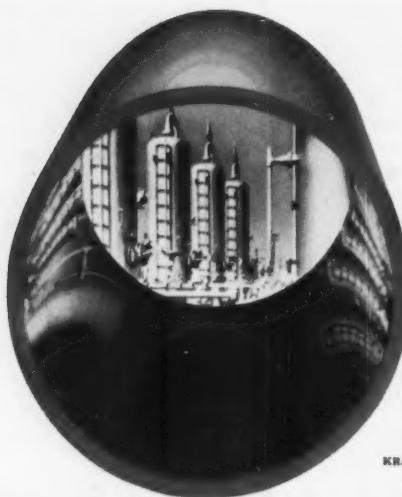
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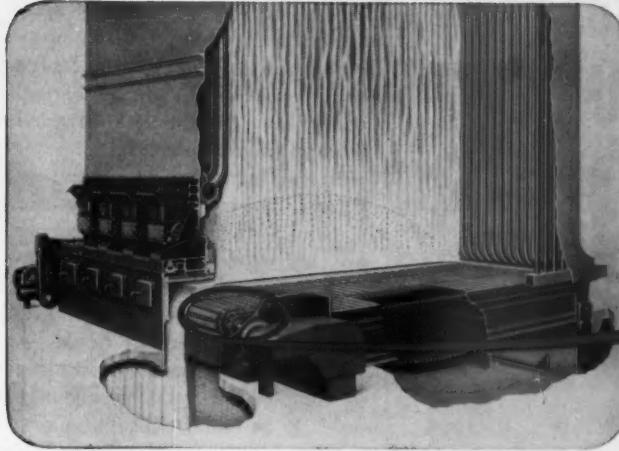
engineering education. One such engineering theory course is thermodynamics. The old thermodynamics course which presented a strange jumble of hardware descriptions, power plant analyses, and pseudo-analyses of hackneyed applications no longer can suffice as a basis for intelligent engineering design. Neither will sending engineering students to the physics or chemistry department for courses in thermodynamics suffice. What we need is a modern engineering theory course in thermodynamics which takes advantage of the student's knowledge of science and mathematics to establish a rigorous understanding of thermodynamic principles.

Engineering Reality

The next step is to establish in the student's mind an intimate relationship between these principles and the reality of engineering systems. The final step is to provide experiences for the students in which they synthesize simple engineering systems from their knowledge of thermodynamics against their total educational experience up to that point.

Although three steps are indicated there is no intention that they be considered in sequence. Rather, they should be considered as overlapping and parallel operations. One good example would be to draw on the student's knowledge of thermodynamics and electricity in the simple design of a thermoelectric refrigerator with an economic value judgment of the practicality of this refrigerator compared with the mechanical refrigerator. He then might be asked to attempt to apply his knowledge of thermodynamics, electricity, and materials in an effort to design an economically practical thermoelectric refrigerator. The result might be trivial in an engineering sense, but the object here is to sharpen his engineering reasoning.

Another example from the other end of the spectrum is the new



Long grate bars with closely fitting overlay joints prevent leakages. Venturi air openings are spaced to provide uniform air distribution.

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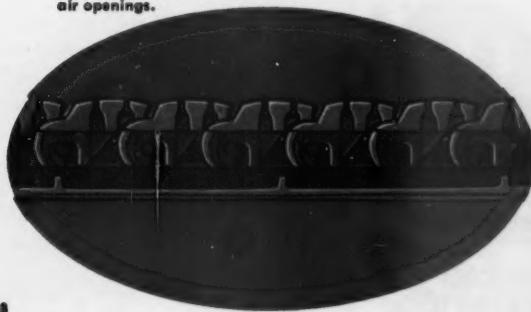
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engineering theory course of magnetohydrodynamics, which may well form the basis for the design of a system by which thermal energy can be directly converted into electrical energy. Here the student will learn that magnetic field theory, fluid mechanics theory, and statistical thermodynamic theory are inadequately developed to support a rigorous and elegant development of magnetohydrodynamic theory. Here, if he is research-minded, he may be inspired to continue in graduate school in order to make his contributions to the development of magnetohydrodynamics as an engineering theory. In his research he will not hesitate to resort to empiricism to make imaginative leaps over gaps in knowledge without the handicap of a predilection for elegance. If he is design-minded he will not hesitate to use the present state of knowledge of magnetohydrodynamics in a bold attempt to design an engineering system which works, even though it is not yet clearly understood.

Selection Determines Field

There are many other engineering theory courses including, for example, statistical thermodynamics, fluid mechanics, mechanics of solids, reaction kinetics, heat transfer, mass transfer, nonequilibrium thermodynamics, and field theory. One cannot hope to be knowledgeable in all of these courses, but one cannot afford to be knowledgeable in only a few. The choice eventually determines the engineer's scope as a designer, and it is this scope which identifies him with a particular branch of engineering.

Another phase of engineering education, which has been sadly neglected as a basis for engineering design, is the laboratory. Too often the laboratory is devoted to routine testing of commercial equipment. The genius of such instruction seems to be its ability to stifle the last vestiges of imagination or

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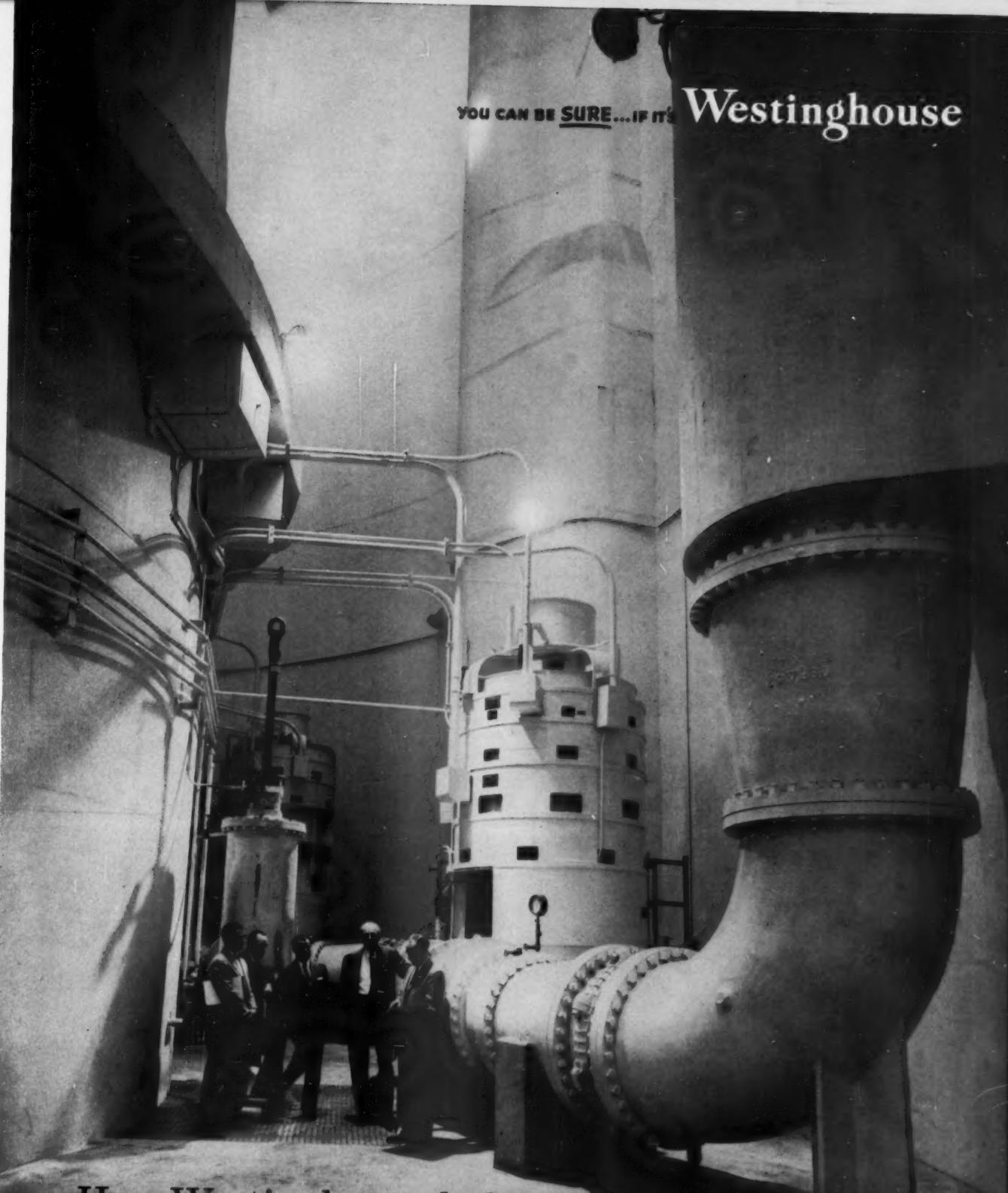
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creativity the student might possess after the sterility of the theory courses usually offered. The ability to conceive physical systems and to experiment with them is a vital feature of engineering design.

Design Courses

The final job for the engineer-educator is the development of solid engineering design courses, often referred to as the professional courses. Unfortunately the obsolete members of a faculty often are pushed into the design courses and the laboratory. The result would be comical if it were not so pathetic. After all the hoopla about science and engineering science these gentlemen continue with their handbooks, the description of old power plants, the analysis of antique refrigerating systems, and a generous portion of opinion, code-following, and perhaps prideful lectures on professionalism. These are the men who resent science and any acknowledgement of its achievements, because their own spirits are so poor.

However, it is abundantly clear that we cannot educate engineers by substituting more science and mathematics for proper design courses. It is also abundantly clear that if the faculty members who teach the engineering theory courses do not assume direct responsibility in the laboratories and the design courses, the tower of Babel will continue to the detriment of the engineering profession. What we need is a capstone of design courses covering broader ranges of engineering activity than the present ones and calling on the total resources of the student derived from his general education, scientific and mathematical education, engineering theory education, and his experience in experimentation to synthesize engineering systems embodying cross currents of principles. Until this is done we shall continue to have "engineering failures" at Redstone and Cape Canaveral. ▲▲



YOU CAN BE SURE...IF IT'S

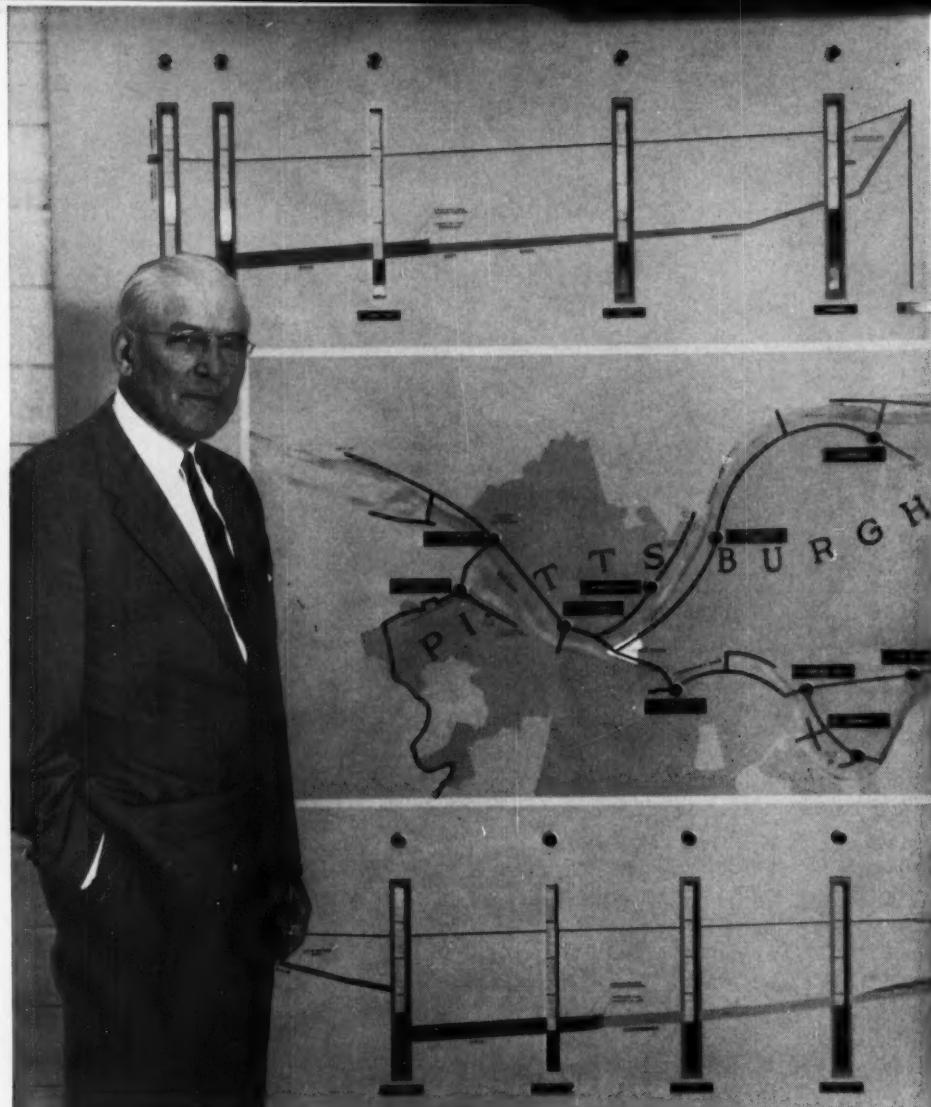
Westinghouse

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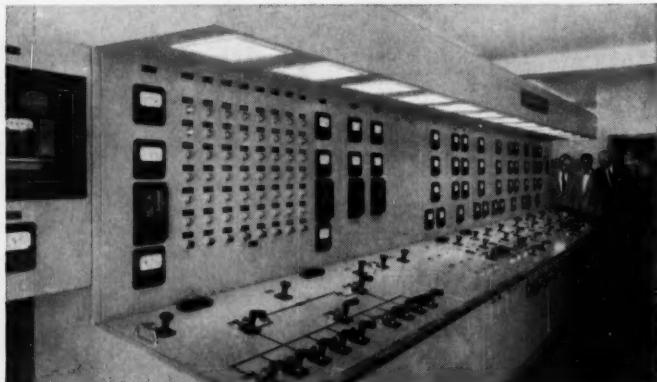
Front Cover: View in dry well of main sewage pump driven by Westinghouse 450/1250-hp 2-speed vertical synchronous motor in foreground. Constant-speed 800-hp motor drives its pump through a variable-speed magnetic coupling. Dry well is illuminated with Westinghouse VEK-16 floodlighting. Discussing installation are: A. B. Janaszek, Westinghouse Sales Engineer; M. B. Trimble, Westinghouse Construction Engineer; N. J. Grady, Devlin & Ernst, Electrical Contractors; J. F. Laboon, Executive Director and Chief Engineer, Allegheny County Sanitary Authority; A. A. Thomas, Engineer for Operations, Metcalf & Eddy, Consulting Engineers.

J. F. Laboon, Executive Director and Chief Engineer of Allegheny County Sanitary Authority, shown beside system flow panel of the \$100 million trunk sewer and treatment plant project which serves 70 separate communities. The mimic diagram depicts flow conditions throughout a 69-mile network of tunneled interception sewers. The plant and its operation incorporate the process of concentrating undigested sludge for incineration.

J-94134-2



Examining sewage treatment system plans in the director's office are N. J. Grady, M. B. Trimble, A. B. Janaszek, J. F. Laboon and A. A. Thomas.



Over-all view of the main duplex control board installed in the sewage pump station. This board centralizes control of the incoming power feeders, indicates alarm conditions for each main sewage pump and also provides centralized control of pump motor speeds and performance. Shown at far end of control board are A. A. Thomas, A. B. Janaszek, J. F. Laboon and N. J. Grady.

Pittsburgh Sewage Treatment Plant builds for population growth of next 40 years

Planning by the Allegheny County Sanitary Authority went far beyond today's needs to anticipate the requirements of 1970 and beyond, to the year 2000. The new Pittsburgh Sewage Treatment Plant which serves the combined populations of 70 separate communities is now capable of handling the increased demands of 1970 populations. In addition, those structures and conduits which are not readily expandable are designed for the ultimate flow demands of the year 2000.

The Westinghouse electrical distribution system specified was planned with the same anticipation of future needs. Each component was selected to perform as part of the completely coordinated system. The entire system is capable of ready expansion to meet the increased power requirements of the future operating load of the plant.

Westinghouse electrical equipment supplied to Power-Up this 150-mgd sewage treatment project (max. rate, 300 mgd) includes:

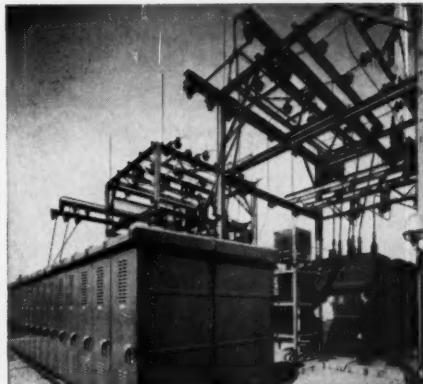
- 10,000-kva outdoor substation.
- Main pump control board.
- Three main sewage pump motors (vertical, synchronous), 1250/450 hp, two speed, two frame.
- Two main sewage pump motors (vertical, synchronous), 800 hp, 400 rpm.
- Two major assemblies of high-voltage fused starters and metal-clad switchgear.
- Five indoor dry-type power centers (150 to 3000 kva).
- Seventeen motor control centers as well as panelboards, dry-type transformers and standard controls.
- Westinghouse Life-Line® motors and gear drives which are utilized on pump, conveyor and auxiliary drives.

(contd.)

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J-94134-3



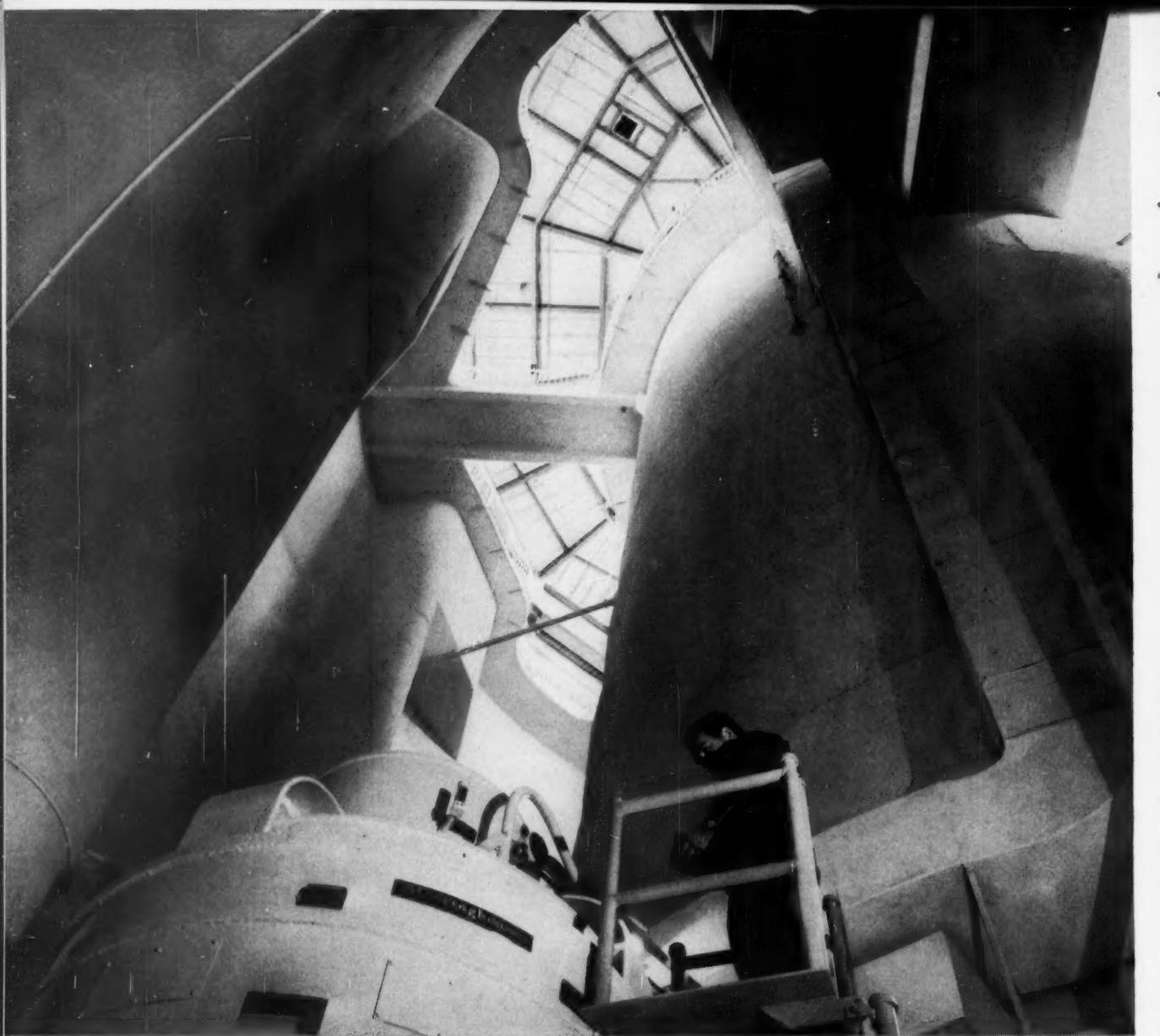
General view of outdoor substation at Pittsburgh Sewage Treatment Plant. Shown is Westinghouse metal-clad switchgear used for incoming line, bus-tie and distribution service, as well as one of the 5000-kva oil-insulated power transformers at the station. Also shown are Westinghouse disconnect switches, grounding resistors and outdoor substation structure. M. G. Grasha, Plant Electrical Engineer, discusses installation with M. B. Trimble.



A. A. Thomas, J. F. Laboon, N. J. Grady and A. B. Janaszek shown in main control room with line-up of Westinghouse Ampgard® fuse starters for control of the main sewage pumping motors. Metal-clad switchgear in the middle of the assembly provides incoming line protection for each starter group. *Trade-Mark



M. B. Trimble and M. G. Grasha inspect electrical equipment in administration building basement. At right is rear of motor control center close-coupled to 150-kva dry-type power center transformer; at left is a 75-kva Type DT-3 dry-type transformer feeding a Westinghouse NLAB lighting panelboard.



General view of main pump station looking from the bottom of the dry well up to the main operating floor level 120 feet above.

Sewage plant builds for next 40 years (contd.)

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CONSULTING ENGINEERS: Metcalf & Eddy, Boston, Mass.

CONSULTING ARCHITECTS: Celli-Flynn, McKeesport, Pa.

ELECTRICAL CONTRACTORS: Devlin & Ernst, Pittsburgh, Pa.

Over-all view of Pittsburgh Sewage Treatment Plant. In foreground are the main sedimentation tanks and the effluent channel which discharges into the Ohio River. Circular building at far right is main pump station, behind which is the incinerator building with 300-ft-high stack, a landmark of the installation.



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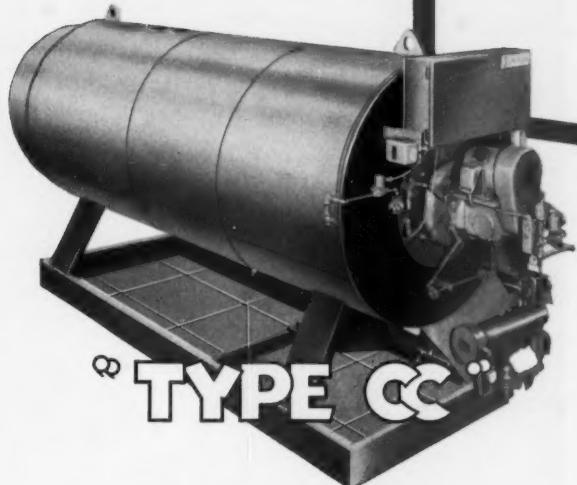
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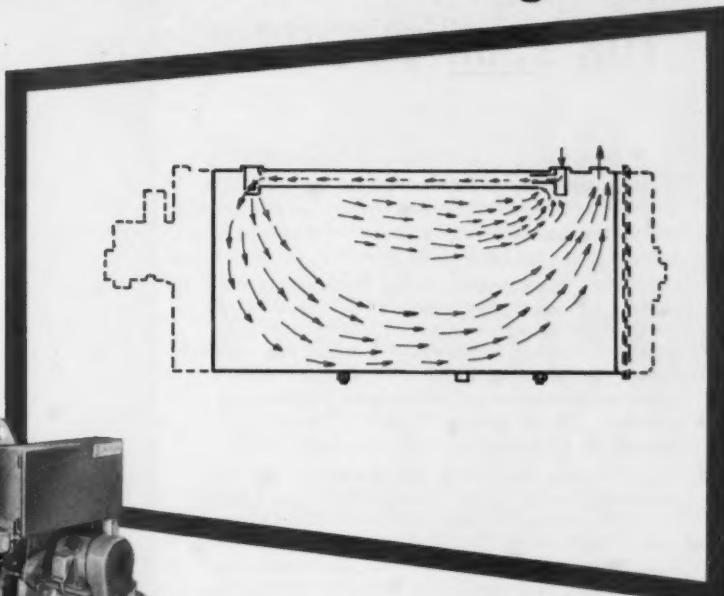
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Thomas J. Robertshaw began his career with Du Pont in 1938. Following wartime Navy service as an Aircraft Finishes Specialist, he returned as Assistant to the Sales Technical Advisor in Philadelphia. In 1952 he was made responsible for Maintenance Sales in New England and upstate New York. Since 1957, he has been Central District Manager, Industrial Maintenance Sales. Among the industries for which he has solved maintenance painting problems: marine, automotive, chemical, steel, petroleum and food.



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Books...

Parallel Reading for Consulting Engineers

Now an engineer has made the *Masters of World Architecture* series. Naturally, it is Pier Luigi Nervi, the Roman. The recently published book was put together by Ada Louise Huxtable, and it contains a quite short but considerably better than usual text describing Nervi, his building philosophy, and his buildings. This is followed by 80 pages of illustrations of Nervi's work. These are the usual competent selection of photographs, architectural renderings, and engineering drawings, but unfortunately the engraving work and the printing is not up to the excellence required of a volume made up predominantly of these reproductions. Also, the paper on which the illustrations are reproduced is an inexpensive coated stock that appears to be yellowing even though it is less than a month from the press.

To compensate, the volume carries up through Nervi's project for the New Norcia, Australia cathedral, giving some excellent sketches and photographs of models. There is also an apparently complete list of Nervi's major works giving location and date, a list of the honors awarded this prominent engineer, and a brief chronology of his life. Finally, there is a bibliography of books and articles by Nervi and on Nervi.

Also to be said in its favor is the price of \$3.95, to be compared with the earlier publication, *The Works of Pier Luigi Nervi*, published in 1957, by Frederick A.

Praeger, at \$10. This earlier work is a trifle better in design and is cased somewhat more expensively, but it, too, suffers from a poor selection of paper that is now cream colored along the edges — inexcusable in a publication of this price and supposed quality. While both have their faults, the new and less expensive book is the better buy. It might be added that any consulting engineer who has not yet had a chance to see what Nervi has done, as illustrated by these drawings and photographs, really has no concept of the possibilities for awe-inspiring designs in reinforced concrete.

If the publisher and engineer-author Alan Chase are able to pull it off, *The Kidneyed Caper* should be the caper of the year. Unfortunately, if it does come off, there will be quite a few confused and disgruntled patrons of the nation's dwindling supply of bookstores. In all fairness, however, it should be conceded that there are probably a few readers who will appreciate the peculiar brand of humor peddled by Civil Engineer Chase, in this, his first book.

The Kidneyed Caper is set in New York City and what most readers probably will assume to be Korea. Its principals are General Coldwater Niclennon Colpitts and Samuel J. Kidney. The former is characterized as are all retired U.S. generals in novels. He is physically fit, strictly regulation,

and refuses to indulge himself in booze, blasphemy, or blondes. The latter is a successful promoter of building projects, up from the gutter, unscrupulous, but at heart a man who can appreciate the sterling qualities of the General — for without such a standard of righteousness, how could he weigh his own depravity against that of his opponents? There is another character too, the General's Icelandic secretary, Gudfinna Magnusdottir. It is obvious that she is Icelandic, for she chust cannot sound out the letter "j." There are other characters, of course, but like the principals, they too seem to be escapees from the pages of novels quickly read, but not quite forgotten.

The book's action centers around the General's efforts to sell Therapellis, an efficacious skin remedy, and capitalism, an apparently unsalable product in backward oriental nations drowning in a sea of foreign aid. It would have been better if both efforts failed, as did the latter. However, it is obvious at story's end that, like the General, Therapellis will not die — it will just fade away.

The Stages of Economic Growth, A Non-Communist Manifesto, by W. W. Rostow, which was reviewed in this magazine in our October 1959 issue following the publication of a condensed version of the text in *The Economist*, has now been published as a book. As

pointed out in our earlier review, this is one of the most important writings of the 20th century and deserves careful study by any consulting engineer who sees the opportunities ahead for engineering participation in the "take-off" stage of the underdeveloped nations.

Books Reviewed in This Issue

Masters of World Architecture — Pier Luigi Nervi, by Ada Louise Huxtable; George Braziller, Inc., New York, New York; \$3.95.

The Kidneyed Caper, by Alan Chase; Simon and Schuster, New York, New York; \$3.95.

The Stages of Economic Growth, A Non-Communist Manifesto, by W. W. Rostow; Cambridge University Press, New York, N. Y.; Cloth Edition, \$3.75; Paper Edition, \$1.45.

New Technical Books

WELDED INTERSTATE HIGHWAY BRIDGES, edited by James G. Clark;

The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio; \$2.50. Fourteen designs are presented in some detail, with written discussions and drawings by the bridge designers selected and abstracted by the editor. The book is essentially a review of current practice on the Defense and Interstate Highway System. Designs include examples of continuous, simple, and cantilever plate girders; conventional and orthotropic plate box girders; as well as double leaf bascules.

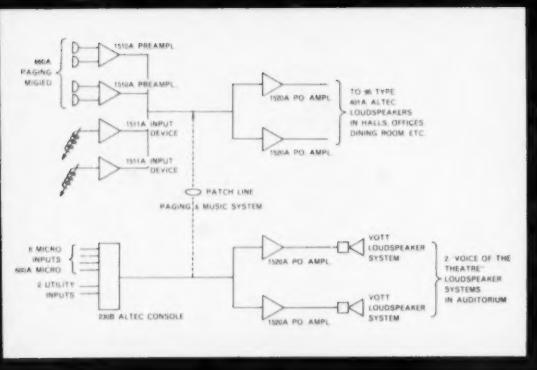
HIGHWAY ENGINEERING HANDBOOK, editor-in-chief, Kenneth B. Woods; McGraw-Hill Book Co., New York, N. Y.; \$25. A first edition, this manual is current and thorough in its coverage of the highway field. Its 1696 pages were prepared by a staff of specialists ranging from college professors to consulting engineers. The book's 28 sections are grouped in four major divisions covering administration, planning,

and traffic engineering; soils, drainage, and earthwork; paving materials and soil stabilization; and engineering design and construction. There are many special sections, including one on photogrammetric techniques and the use of digital computers. Material is easy to find, and illustrations are ample.

CHEMICAL ENGINEERING PLANT DESIGN, by Frank C. Vilbrandt and Charles E. Dryden; McGraw-Hill Book Co., New York, N. Y.; \$12. This book is one of the McGraw-Hill series in chemical engineering, and has been used as a basic text for the past 20 years. The revised fourth edition is completely reorganized in sequence, and has been almost completely re-illustrated. Material has been thoroughly updated, and is of considerable value to the consulting engineer's staff for quick review or basic reference.

DYNAMICS OF FRAMED STRUCTURES, by Grover L. Rogers; John Wiley

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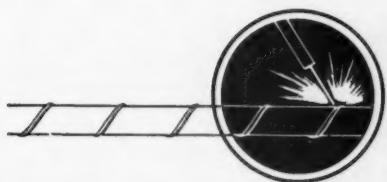
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& Sons, Inc., New York, N. Y.; \$10.25. Using matrices and orthogonal functions, this book presents the analytical aspects of dynamic disturbances in structures from the modal analysis viewpoint. It deals with stresses and strains in structures during and after earthquakes, action of moving loads, deflections and bending moments, and velocities and shear forces in structures affected by dynamic disturbances.

THE INTERNAL COMBUSTION ENGINE IN THEORY AND PRACTICE, Vol. I, by Charles Fayette Taylor; The Technology Press and John Wiley & Sons, Inc., New York, N. Y.; \$16. Thermodynamics, fluid flow, and performance are the subjects covered in the first of a proposed two-volume series. An attempt is made to establish a quantitative background for new design and development, and for the proper evaluation of the performance of existing types of internal combustion engines. The second volume,

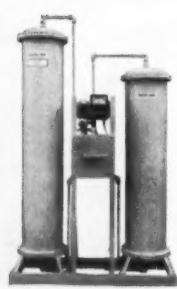
now in preparation, will deal with such topics as fuels, combustion, materials, and design.

THEORY OF PLATES AND SHELLS, by Stephen B. Timoshenko and S. Woinowsky-Krieger; McGraw-Hill Book Co., New York, N. Y.; \$15. Originally copyrighted in 1940, this book has been thoroughly revised in the light of extensive literature in the field of plate and shell theory and design which has appeared since that date. As before, the book discusses the deformation of bodies in which one dimension (the thickness of a plate or shell) can be considered as small in comparison with the other dimensions. Material has been expanded considerably, and several new topics introduced.

OPEN-CHANNEL HYDRAULICS, by Ven Te Chow; McGraw-Hill Book Co., New York, N. Y.; \$17. This is the first English-language book on the subject in two decades. It is

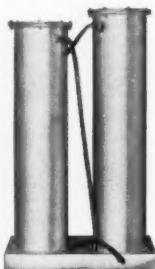
designed for use in the classroom as well as in the offices of practicing engineers. It deals with the design for flow in open channels and their related structures, and bridges the gap between theory and practice. An attempt has been made to simplify theory by adoption of less rigorous treatments based on sound concepts, and by avoiding the use of advanced mathematical manipulations. To facilitate understanding of the subject matter, the treatment is based primarily on the condition of one or two dimensional flow. In the main, current American practice is dealt with, although related information from all over the world is included.

THE AERODYNAMICS OF POWERED FLIGHT, by Robert L. Carroll; John Wiley & Sons, Inc., New York, N. Y.; \$8.50. This book represents a new approach to the subject of aerodynamics — a concept of lift based on an analysis of rocket thrust. A serious defect is the lack



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of an adequate glossary, although a definition of each new term is supplied at or near its first use in the book. Chapter 1 is concerned with the basic mechanics of aerodynamic theory. In Chapter 2 the mechanics of flow against a flat plate are developed, leading to an extensive discussion in Chapters 3, 4, and 5 of Bernoulli's Law of Fluid Dynamics and the concepts of lift and drag in incompressible flow. In Chapters 6 and 7 the compressibility effects in subsonic flow are explained. Shockwave formation and supersonic flight are introduced and elaborated at length in Chapters 8, 9, 10, and 11. Propeller theory is explained in Chapter 12 and the last chapter introduces aids to experimental testing.

FLUORESCENT LAMPS AND LIGHTING, edited by W. Elenbaas; The Macmillan Co., New York, N. Y.; \$11.00. As a result of the rapid developments in the field of fluorescent lighting this new edition follows

the original so closely that the two may be confused. The original was edited by C. Zwikker and is essentially the same in organization with the same contributors and material. In addition to the up-dating of the book, a few minor changes should be mentioned. By combining the chapters on lamp types, starters, and circuits into one chapter, "Lamp-Types and Circuits," it has been possible to proceed more logically, as these subjects are interrelated. The original chapter on ballasts has been divided into two parts. The first discusses the stabilization of the discharge and precedes the chapter on "Lamp-Types and Circuits" and the second, which immediately follows this same chapter, deals with the subject of ballast construction.

The development of fluorescent lamps with high loading per unit length has been so continuous as to preclude its inclusion in the existing chapters. Instead, it is treated in the appendix with a separate

section. Transistor applications are also treated in this manner.

INDUSTRIAL PACKAGING, by Friedman & Kipnes; John Wiley & Sons, New York, N. Y.; \$11.50. The purpose of this book is to present a basic understanding of industrial packaging, with major emphasis on selection of materials, methods, and equipment. Those areas where sales acceptance is influenced by packaging techniques are considered "consumer packaging" as opposed to "industrial packaging" and only treated where overlapping of material occurs.

The book is divided into three essential parts. The first part discusses historical aspects with emphasis on the development of packaging techniques. The second part, "Packaging Material and Containers," covers the media used to cover and protect products in distribution. The last part, "Packaging Methods and Equipment," concerns the integrated aspects of



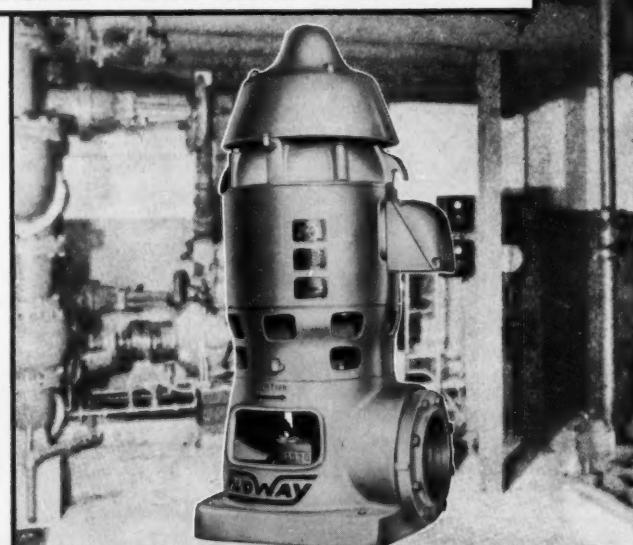
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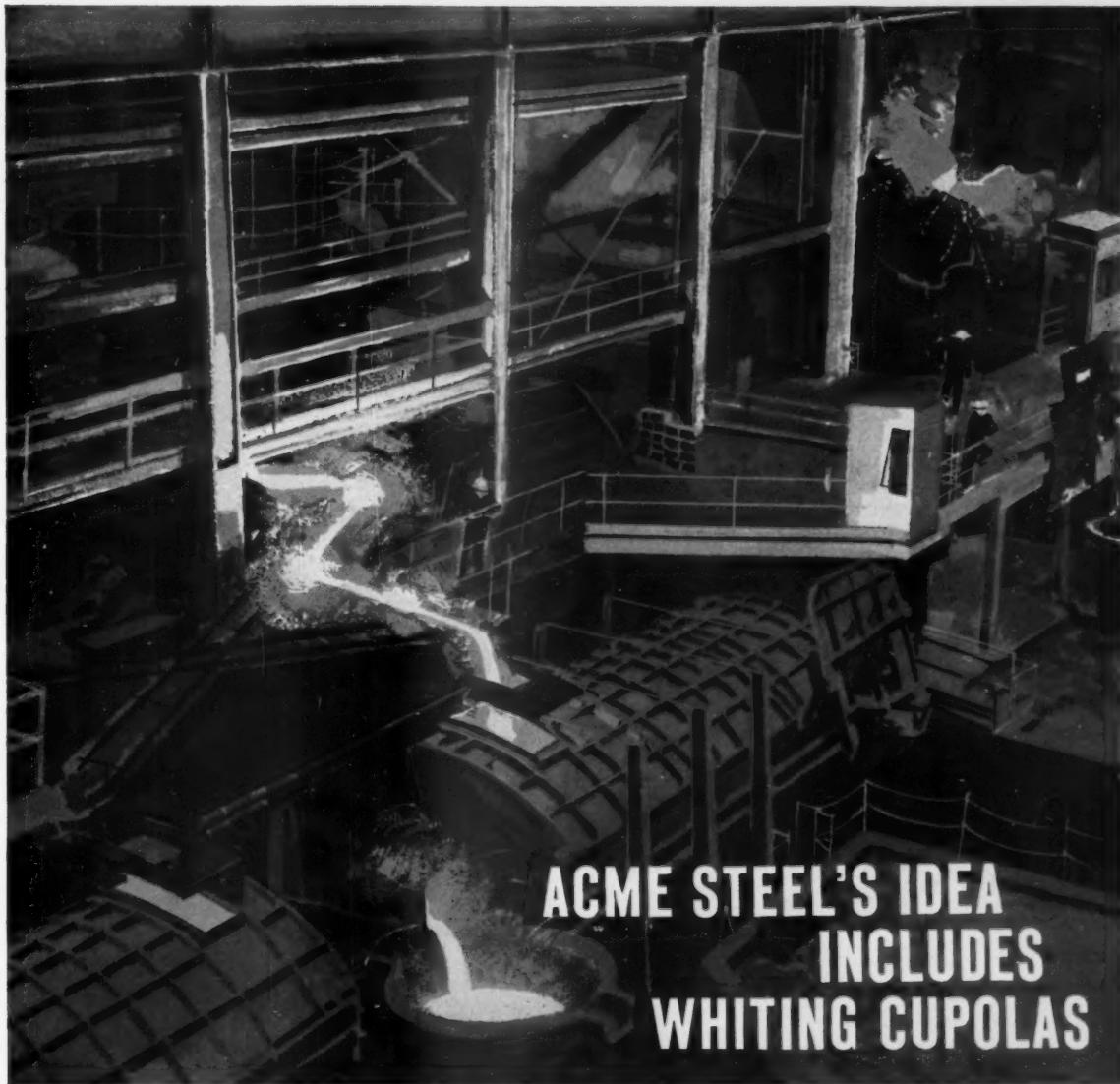
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packing and packaging. There is no attempt to list different types of material or equipment, as in a handbook or manual, and only those items necessary to the presentation of packaging functions are included. Both authors are consulting engineers practicing in the field of packaging.

CONTINUOUS ANALYSIS OF CHEMICAL PROCESS SYSTEMS, by Sidney Siggi; John Wiley & Sons, New York, N. Y.; \$8.50. Continuous chemical analysis as a means of chemical process control is a new but already accepted technique. In most instances, the analyses are automatically recorded with sensing equipment geared to control mechanisms so that operating conditions are kept at the optimum level. In addition, these methods can be used to operate alarm systems when the operation is of a hazardous nature. Manufacturers are daily finding new uses for these techniques.

This book is a compilation of this kind of instrumentation and its application. It presents material which is scattered for the most part in uncatalogued literature and is, therefore, difficult to locate. Manufacturer's bulletins as opposed to advertising literature are the source material for the book. Consultants in this field will find the volume a practical and handy reference.

PUBLIC ROADS OF THE PAST, published by the American Association of State Highway Officials, 917 National Press Building, Washington 4, D. C.; 2 volumes; \$2.50 the set. This history of roads from past to present is contained in two volumes. Volume I describes roads from 3500 B. C. to 1800 A. D. Starting with the oldest road in the world and Roman road-building tools, it considers the transition from animal to mechanical horsepower, the origin of engineering measures, the development of sur-

veying instruments, and finally, the highways of early Americana.

Volume II is about historic American highways and concerns important roads that were built up to and including 1945. Maps, charts, and illustrations accompany each chapter of each volume. The early use of some modern road surfaces also is described.

MOTOR SELECTION AND APPLICATION, by Charles C. Libby; McGraw-Hill Book Co., Inc., New York, N. Y.; \$13.50. The art of motor selection is described in this book in terms of load characteristics, service requirements, space limitations, safety, and duty-cycle requirements. This material is carefully edited and organized for maximum utility. The book itself is directed toward mechanical rather than electrical engineers, and emphasizes a qualitative rather than a quantitative approach throughout. All data included conforms with the accepted standards



Over 300 million feet in use coast to coast!

The test of time has proved the high quality of Orangeburg Root-Proof Pipe and Fittings for house sewer lines, downspout run-offs and other underground, non-pressure uses.

Orangeburg's Taperweld Joints seal root-proof and watertight. No leakage, no infiltration. And because it's made of a strong, tough non-metallic material, Orangeburg does not rust. Alternate freezing and thawing... acids and alkalies found in ground water and sewage do not affect it.

All these qualities plus speed, ease and economy of installation have

gained for Orangeburg a growing acceptance among leading approving authorities, architects, engineers, builders and plumbers. Today, over 300 million feet of Orangeburg are in service from Maine to California.

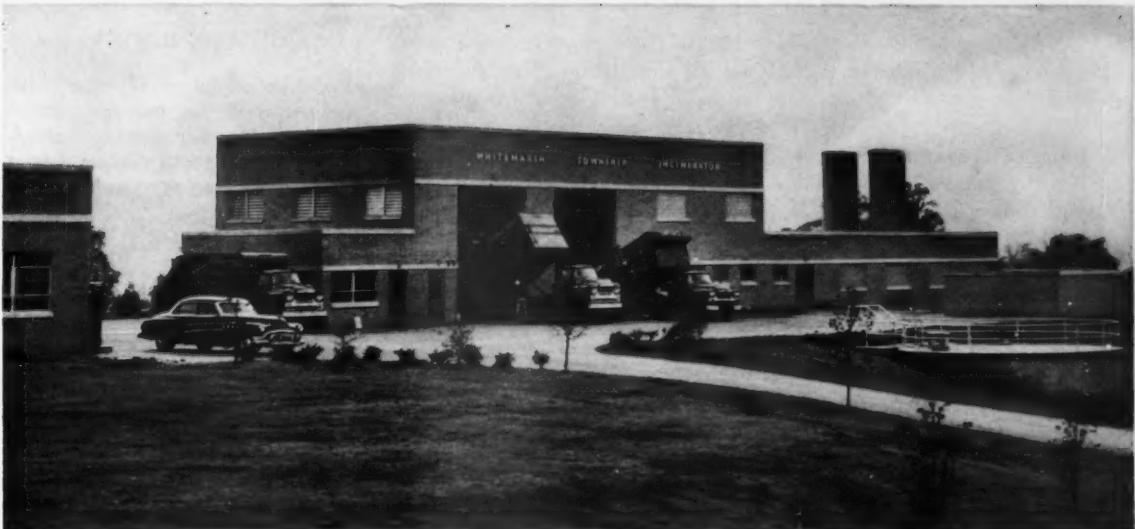
The Silver Band* identifies genuine Orangeburg: Root-Proof Pipe for sewer lines; Perforated Pipe for foundation drains, septic tank disposal fields. Orangeburg exceeds requirements Federal Spec. SS-P-356 and Commercial Standard CS 116-54. Write Dept. CE-50 for Engineer's independent report.

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Division of The Flintkote Company, Manufacturer
of America's Broadest Line of Building Products

genuine ORANGEBURG®
Root-Proof Pipe and Fittings



The new incinerator at Whitemarsh. Note the neat compact lines of the building and the low stacks of the wet scrubbers which emit only a plume of steam. Glace & Glace Inc. were consulting engineers for the project.

Only these four men are needed to operate the plant: One man to weigh incoming trucks and supervise unloading, a second to operate the conveyor, a third to load and drive the truck carrying away the non-combustible residue, and a supervisor.

Storage conveyor consists of two, 50-ton capacity oscillating hoppers placed side by side but independently controlled. Material is moved to feeders in a series of short reciprocating arcs. This action is self-scouring and keeps the storage trough completely clean.



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NEW PRINCIPLE INCINERATOR eliminates mess and fumes—is economical to operate

Designed to burn 12½ tons of refuse *per hour* without odor or dirt, this new incinerator is in operation at Whitemarsh, Pa. In addition to garbage, tin cans, lawn trimmings and wastepaper, the incinerator handles undigested sludge from an adjacent sewage plant. Located in a residential section, plant exterior and landscaping are designed to harmonize with their surroundings.

The Dravo Incinerator has a number of unique features. Of primary significance are: the continuous flow design, which permits rapid and easy

handling of the refuse; the water wall furnace, which permits the use of sufficiently high temperatures to provide thorough combustion and the elimination of noxious odors; and the wet scrubber and residue disposal system, which together promote the maintenance of healthful cleanliness.

Automatic operation has been stressed, only four men are required to run the entire plant. Present needs demand operation of the plant for only one 8-hour shift, but since it can be run on a 24-hour basis, there

is adequate capacity for future needs.

The Dravo Incinerator is the economical solution to the problem of sanitary, convenient refuse disposal. For full information, write or call DRAVO CORPORATION, PITTSBURGH 22, PENNSYLVANIA.

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of ASA, AIEE, and NEMA which apply to integral-horsepower, polyphase motors and to dc motors.

THERMODYNAMICS, 2nd Edition, by Franklin P. Durham; Prentice-Hall, Inc., Englewood Cliffs, N. J.; \$8.35. This is a textbook designed for classroom work but may also be used as a home study and reference text. The first six chapters develop the basic theory which is summarized in Chapter Seven. Chapters Eight through Twelve are specific applications of the basic theory and may be studied in any desired order except that Chapter Eleven should not precede Chapter Eight. Chapter Thirteen on gas dynamics and Chapter Fourteen on heat transfer are included as basic references in these highly specialized fields.

CUTTING THE COST OF YOUR EDP INSTALLATION, by Canning, Sisson and Associates, 1140 South Robertson Boulevard, Los Angeles, Calif.;

\$50.00. The most expensive element in the installation of an electronic data processing system is planning and preparing the computer site. This special report, a compilation of six actual computer installations, covers this problem in detail.

Throughout the book special emphasis is placed on organization, with the line of authority well defined; the key cost-incurring decisions which must be made; administrative details; and those areas where special technical know-how is required. All of the major computers in use today are compared in terms of cost and capability.

A list of the Important Technical Books Published in 1959 appears on page 248 of this issue of **CONSULTING ENGINEER**. It is published for the convenience of those readers who are interested in keeping their personal or office technical libraries current. Books may be ordered through **CONSULTING ENGINEER**. □□

ARTICLE REPRINTS

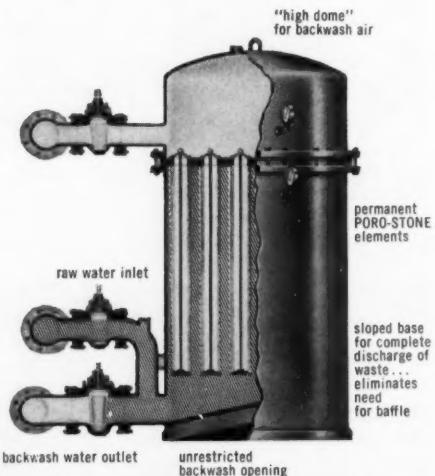
For free copies of reprints listed below, write on company letterhead to Reader Service Dept., **CONSULTING ENGINEER**, 217 Wayne St., St. Joseph, Mich.

- "Designing Flat Plates and Slabs"
- "Who Does What?"
- "The Consultant and the Computer"
- "A New Way to Pretension Prestressed Pavement"
- "Cutting the Cost of Nuclear Power Plants"
- "Getting Along — Professionally"
- "Preparing Accurate Budget Estimates"
- "Controlling Vibration With Soil Stabilization"
- "Specify Low Alloy Steel for Bridges"
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- "Lee's Lecture — Professional Wrestlers And Professional Engineers"
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- "Hospital Engineering"
- "Some Neglected Design Problems of . . . Circulating Water Systems"

ADAMS SWIMMING POOL FILTERS

- PERMANENTLY TROUBLE-FREE OPERATION
- CRYSTAL-CLEAR WATER AT LOWEST COST
- SAVINGS IN FIRST COSTS, LABOR, CHEMICALS

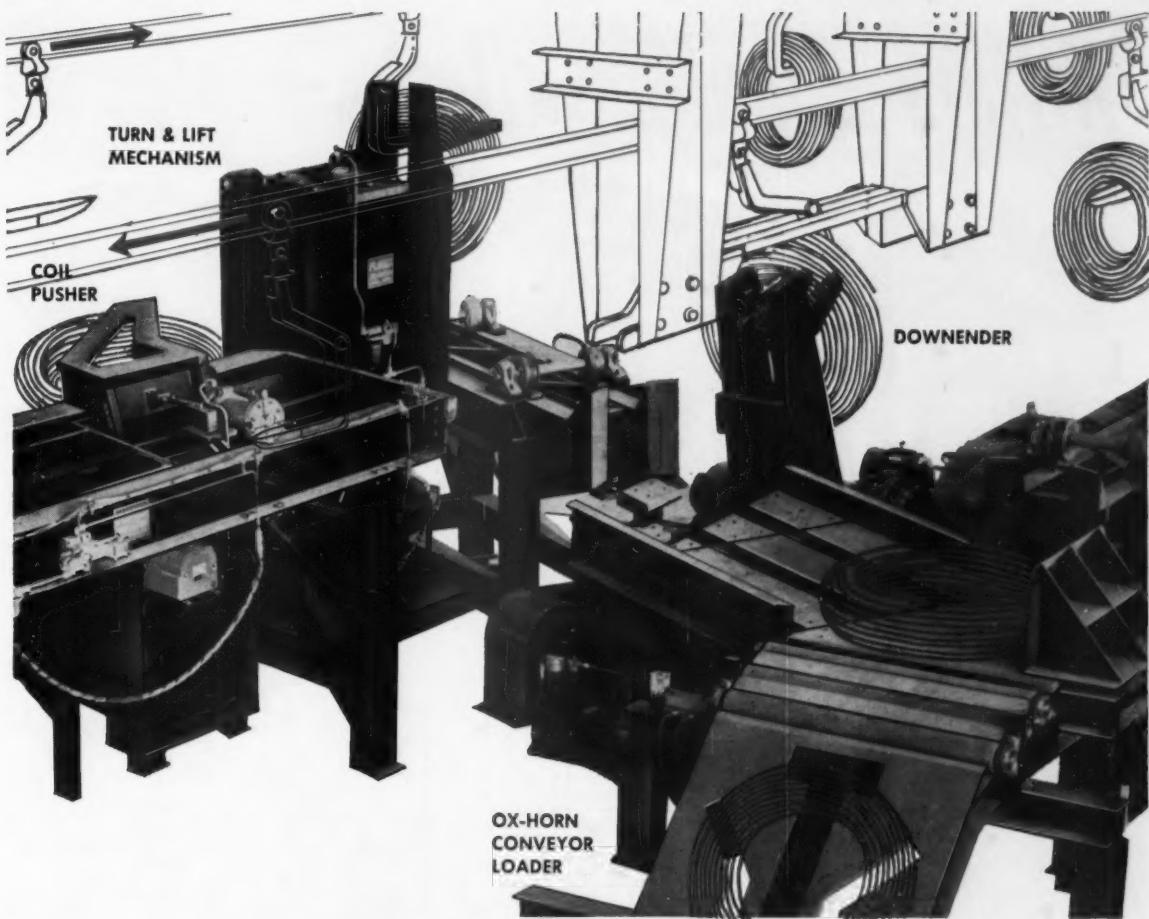
Adams SPF Diatomite Filters require only a fraction of the installed space of sand filters of equivalent filter capacity. Operation is very simple — nothing to disassemble or replace. Adams "pressure dome" backwashing is easy, rapid and extremely thorough yet requires a minimum amount of wash water — "...the only diatomite filter with backwashing that works", as one pool operator puts it. Adams Porostone filter tubes are rugged and inert to corrosion — none has ever needed replacing. And Adams diatomite filtration removes microscopic particles including many bacteria, greatly reducing your requirements for chlorination, precipitants and pH control. Write for Bulletin 626 for details on better filtration . . . by the country's largest manufacturer of filters for public and commercial swimming pools.



MUNICIPAL POOL

at Winnsboro, S. C. One Adams SPF-238 Filter keeps its 300,000 gallons crystal-clear. Pool designed by Hugh N. Thompson, City Manager, Winnsboro, S. C. General Contractor: John C. Stewart Co., Winnsboro, S. C.

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256 EAST PARK DRIVE
BUFFALO 17, N. Y.



another example of Planet Versatility...

COIL HANDLING SYSTEM LOADS AND UNLOADS EXISTING CONVEYORS AUTOMATICALLY

This automatic coil handling system is an example of how *Planet Versatility* helped one of America's largest steel mills modernize its 10-inch bar mill to handle larger, 2000-pound bar coils . . . and save money by designing the coil handling equipment to load and unload existing conveyors.

A red-hot, 2000-pound bar coil is transferred from an existing drag-chain conveyor to the automatic trolley conveyor loader by a single arm coil pusher. The coil pusher deposits the coil on a drop table which, when lowered, leaves the coil hanging on one arm of a turn and lift mechanism. As this machine revolves 180 degrees it lifts the coil into position to be engaged by a trolley conveyor hook and, at the same time, lowers its other arm to receive the next coil. After cooling on the existing trolley conveyor, a downender removes the coil and sets it on a slider bed on which it is indexed into a banding position. The coil is then transferred onto an existing ox-horn conveyor. *The entire system operates on a 15-second cycle and is completely automatic.*

This automatic coil handling system is more evidence of *Planet's* versatility . . . its ability to engineer, manufacture, and erect automated systems which solve the most perplexing production, materials handling, and automation problems. *Planet* has automated production lines, built bulk and unit materials handling systems, designed and erected complete plants . . . and *Planet* systems are found in the plants of leading manufacturers in almost every industrial classification.

Write or phone to have a *Planet* engineer demonstrate how "PV" can help you . . . you'll find *it pays to plan with Planet*.

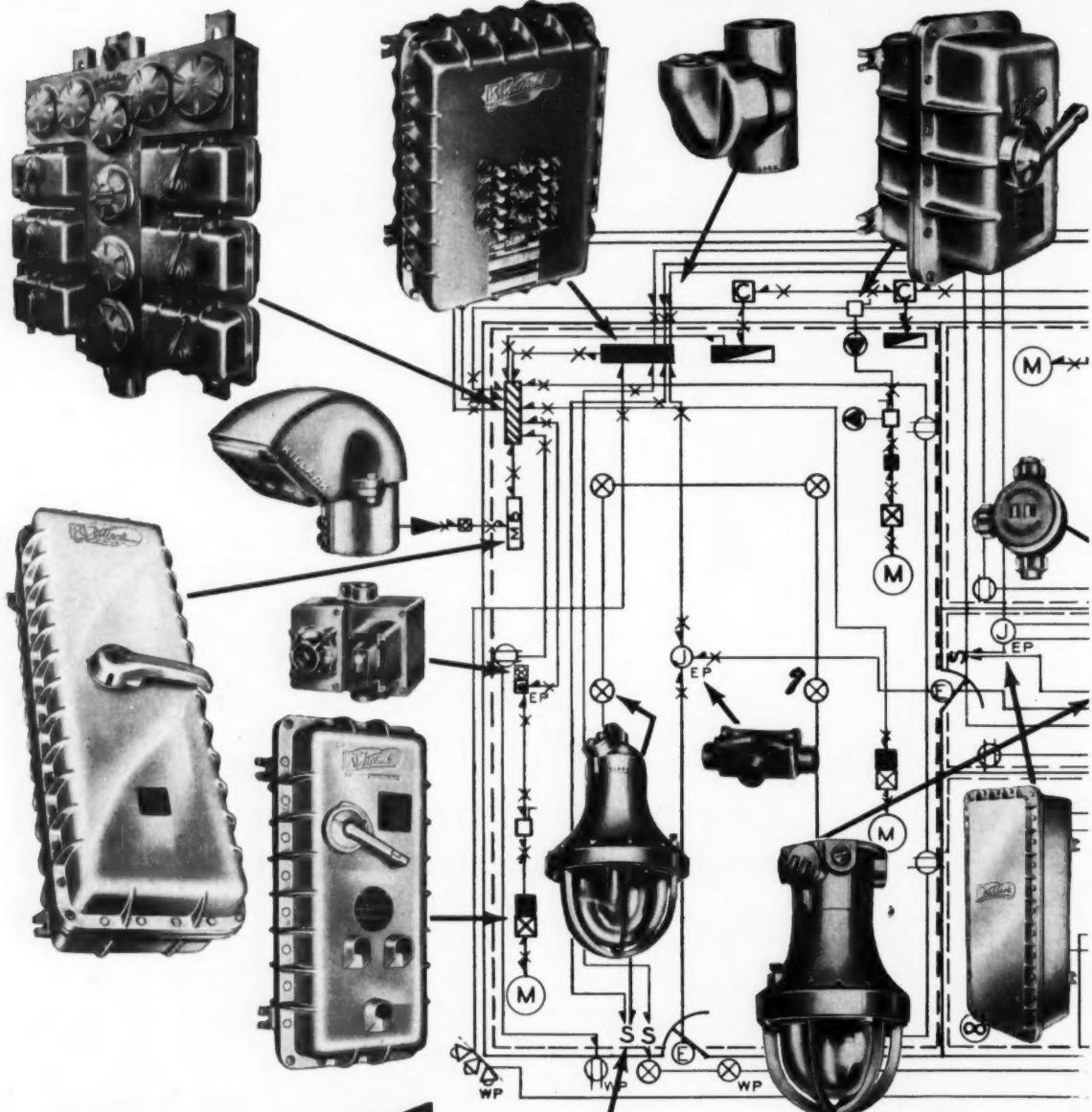
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Industrial Handling Systems
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Killark supplies all the explosion



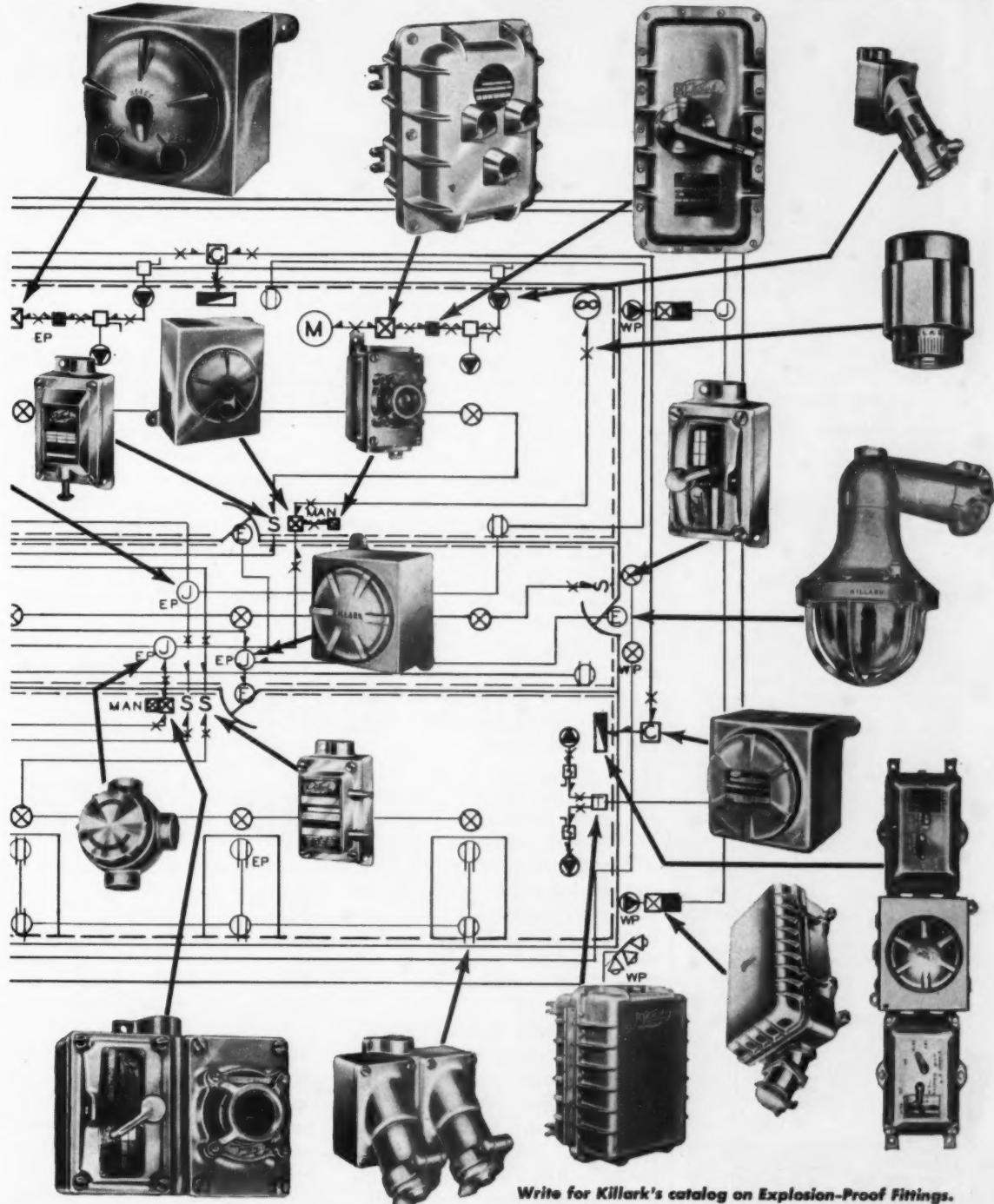
Killark



This wiring diagram shows just a few of the thousands of Killark aluminum fittings and fixtures available for protecting any point in an explosion-proof electrical system. From service entrance fittings, thru main breaker, power and light panels, circuit breakers, motor starters, junction boxes, switches, and conduit fittings, Killark offers high quality aluminum fittings for hazardous and non-hazardous areas. More than 4500 items are supplied from stock at 19 convenient warehouses throughout the United States and Canada.

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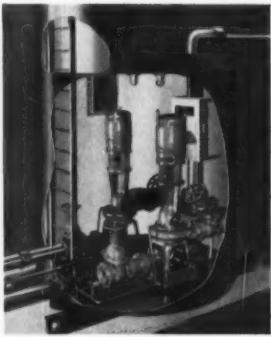
- proof equipment you need...



Write for Killark's catalog on Explosion-Proof Fittings.

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WAREHOUSE STOCKS IN NINETEEN CITIES**

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A PACKAGED PUMP STATION
THAT MEETS **all**
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Compare motor and pump assembly of this duplex sewage pump station with any other and see the **TEX-VIT** superiority. Individual shaft for each pump and each motor. Four bearings per assembly instead of two. Heavy, corrosion protected steel shell.

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Exclusive **TEX-VIT** controls are actuated by pressure variation within the wet well. No compressor; no floats or other moving parts in the wet well.

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Extra large blower provides complete change of air every 60 seconds. Air inlet and outlet are at opposite sides of station to prevent short circuiting of air. Refrigeration-type dehumidifier.

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Pumps, motors, controls, and other components bear the brand names you would expect to find in a *Who's Who of American Industry*. You know you get the best when you specify **TEX-VIT**.

INSTALLATION TESTED AND PROVED

TEX-VIT packaged pump stations are setting new standards. Names of municipal and industrial users furnished on request.

Let **TEX-VIT** help with your sewage lift problems.

Write for
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TEX-VIT
SUPPLY COMPANY
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Dept. CS



Men in Engineering

Brucock Harstead have been named consultants to the firm and Dr. Hannskarl Bandel, associate.

Duffill Associates Inc., consulting engineering firm, of Boston, Massachusetts, has moved to new and larger headquarters, located at 648 Beacon Street.

R. M. Doering, assistant chief of the power division of Albert Kahn Associated Architects & Engineers, Detroit, has been appointed chief power plant engineer of the firm. Doering succeeds Paul Preuthun who has retired after 37 years of association with the firm.



DOERING

LARSON

Ernest O. Larson, one of the nation's leading reclamation engineers, has joined the consulting engineering firm of Berger Associates as its chief consultant. He has been assigned to the Salt Lake City office but will be available to all Berger offices in Orange, New Jersey; Harrisburg, Pennsylvania; Geneva, Switzerland; Paris, France; Bonn, Germany; and Rangoon, Burma. Larson recently retired from the U. S. Bureau of Reclama-



Handling **Hot Fumes?** ***Bifurcate 'em!***

A protective housing shields a DEBOTHEZAT Bifurcator motor from contact with hot and corrosive fumes. Special alloys for housings and fan wheels are available for extremely corrosive fumes. The result: smoother operation and lowered motor maintenance costs. In-the-duct installation of DEBOTHEZAT Bifurcator Fans saves valuable space and ends sharp-corner deflection of exhaust flow. Friction is reduced and velocity increased.

Direct-drive DEBOTHEZAT Bifurcator Fans economize fume removal problems in a wide variety of applications. Contact a DEBOTHEZAT engineer NOW, or write Dept. COE-560.

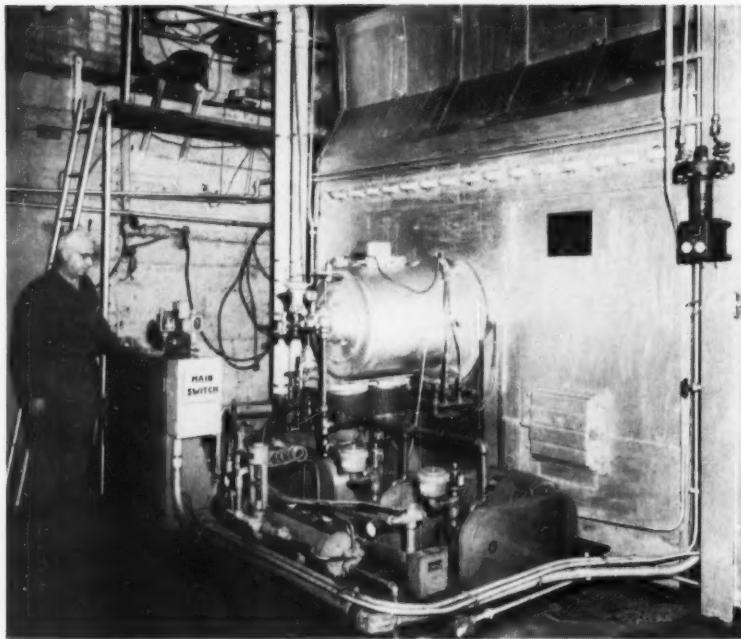
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No Fuel Burning System Can Match O & S for Efficiency

Superiority of O&S burner systems can be demonstrated by these facts:

1. **Extraordinary Fuel Savings**—Impressive fuel savings are provided at *all* firing rates. Savings often pay for investment in a matter of months.
2. **Efficiency**—Higher *guaranteed* burner efficiency over a wider turndown rate than any other burner system.
3. **Performance**—O&S burner systems outperform all other assemblies. 5 to 1 turndown without increase in excess air ratio is widest in industry. Combustion air, accurately controlled, plays *no* part in atomization.
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World Leader in Packaged Boilers and Burners

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tion after 37 years of service. He was one of its pioneers and contributed materially to the development of the water resources of the Upper Colorado River Basin.

Harold E. Vann, formerly chief, Planning Section, Division of Reactor Development, Atomic Energy Commission, has been appointed manager — nuclear projects of Jackson & Moreland, Inc., consulting engineers, Boston, Massachusetts.

Malcolm Pirnie Engineers, consulting civil and sanitary engineers, New York, New York, announce that Alfred C. Leonard has joined the partnership. Leonard has been an associate of the firm during the past several years.

R. W. Fisher, Jr., formerly principle engineer with Kaiser Engineers, has been elected a vice president of Kaiser Engineers Overseas Corporation. Fisher's first assignment is project manager of a 100,000-ton per year portland cement plant being designed and constructed for Mysore Cements Ltd., Ammasandra, Mysore State, India.

De Leuw, Cather and Company, Chicago consulting engineers, has opened an office at 744 Broad Street, Newark, New Jersey. Robert B. Richards, chief engineer, is in charge of the new office.

T. Y. Lin Associates, consulting engineers, Van Nuys, California, announce the opening of offices in Caracas, Venezuela, in association with the architectural and engineering firm known as AISA.

In a move to intensify its foreign activities, Arthur G. McKee & Company, Cleveland engineering and construction firm, has formed a new operating subsidiary in Mexico and is forming a similar firm in Brazil. The Mexican subsidiary, A. G. McKee de Mexico, S. A., will be headquartered in Mexico City. The establishment of



Flexible wiring system for Jacksonville City Hall with SPANG

Underfloor Duct and Headerduct. Three-duct runs of Underfloor Duct in concrete slab construction carry electrical, phone and intercom wiring on first floor. Upper 15 floors are served by Headerduct in cellular-floor construction. Simplicity of Spang Raceway Systems provided a time-saving, trouble-free installation. Future wiring changes can be made quickly, easily without costly reconstruction, making City Hall modern for years to come. For full information, write to Spang.

Architect: Reynolds, Smith & Hills, Jacksonville
General Contractor: The Auchter Company, Jacksonville
Mechanical Contractor: Henley and Beckwith, Jacksonville
Electrical Contractor: Wesley Paxson Co., Jacksonville
Spang Distributor: Ace Electric Supply, Jacksonville



THE NATIONAL SUPPLY COMPANY

Two Gateway Center, Pittsburgh 22, Pennsylvania

Subsidiary of Armco Steel Corporation



Your ideal source for custom-designed cranes

CONCO



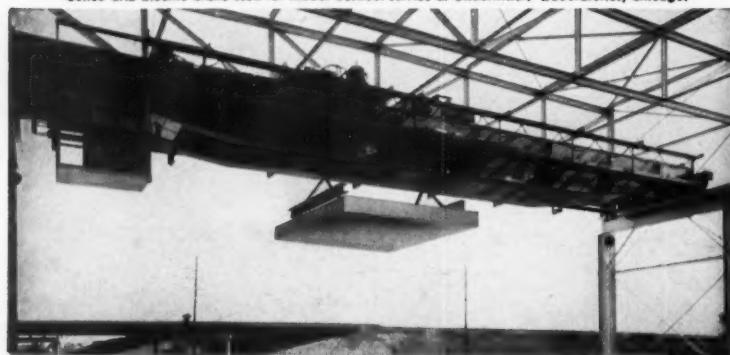
A crane, custom-tailored in every detail to your client's needs, is available from Conco at a practical cost. Here you'll find engineering experience spanning 35 years, and unique plant flexibility that permits easy handling of specialized cranes—spark and explosion proof, indoor-outdoor, circular, and cranes employing closed circuit TV for remote-control operation. May we submit a proposal on your next crane requirement—whether standard or highly specialized.

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AFFILIATES: Spartan Tool Division — Powered Sewer Cleaning Equipment • Field Control Division — Barometric Draft Controls • Conco Building Products, Inc. — Brick, Tile, Stone

Conco CRB Electric Crane used for indoor-outdoor service at Underwriters' Laboratories, Chicago.



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104 YEARS
OF EXPERIENCE
STAND BEHIND
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McDonald 4701 Corporation Stop — Standard A.W.W.A. thread for copper service pipe. Sizes from $\frac{1}{2}$ inch to 2 inches. A catalog of McDonald's complete line of brass goods is available on request.

A.Y. MCDONALD MFG. CO. Dept. CE 560, 12th & Pine, Dubuque, Iowa
Brass Goods • Pumps • Oil Equipment • Drains

the two new firms followed the formation last August of a British company, McKee Head Wrightson Limited, to engage in the designing, engineering, and building of petroleum and chemical plants overseas. The British company is jointly owned by McKee and Head, Wrightson & Co. Ltd., of Thornaby-on-Tees, England.

New address of the office of Edward T. Wiesmann, consulting electrical engineer, is 620 Bessemer Building, 100 Sixth Street, Pittsburgh 22, Pennsylvania.

At the recent annual meeting of the board of directors of Rogers Engineering Co., Inc., consulting engineers of San Francisco, California, four additional new members (representing each branch of engineering served by the firm) were elected to the board. The new directors are: William E. Daniels, vice president, representing the electrical division; Milton Bergson, chief civil engineer; John Power, general manager of the firm's new Antioch office and mechanical engineer; and Lloyd C. Sindel, mechanical engineer and head of the firm's special design group.

Announcement also has been made of the establishment of a branch office at Antioch, California. This is a completely integrated engineering office, with civil, electrical, and mechanical engineers.

John B. Kelley has been appointed assistant to the executive vice president at Burns and Roe, Inc., New York City engineers and constructors. In addition to other assigned duties, Kelley will coordinate foreign operations of the company. In his former position as project manager and assistant to the director of the defense and aeronautical facilities division, Kelley directed design, engineering, and siting for the SAGE (Semi-Automatic Ground Environment) system.

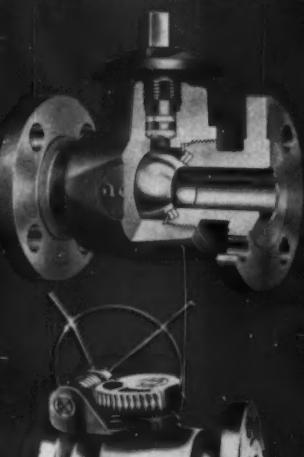
Burns and Roe also has named Robert W. Sabel as assistant man-

"Install 'em anywhere— no maintenance needed"



PRODUCT OF W-K-M's

Creative Engineering



ACF non-lubricated Ball Valves feature Teflon stem gaskets and seats. There's no lubricant to cause sticking or contamination.

Working Pressures: In carbon steel with ASA ratings of 150 pound and 300 pound, and some sizes in ASA 600 pound; in semi-steel with 200 and 400 pound WOG ratings.

Sizes: $\frac{1}{2}$ " through 6". Regular port valves up to 8" x 6".

5922



ACF non-lubricated Ball Valves

ACF Ball Valves are not only non-lubricated . . . but designed *throughout* for maintenance-free performance. For example: The ball is suspended between Teflon* seats under compression for leakproof sealing. Seats are protected from the lading flow. And the full bore conduit provides *smooth* flow, with no destructive turbulence . . . no more pressure drop than through an equal length of pipe.

A quick quarter-turn operates this rugged valve. Specify it. You'll get efficient, economical performance. *Available from leading suppliers everywhere.*

* Du Pont Trademark

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W-K-M

DIVISION OF ACF INDUSTRIES
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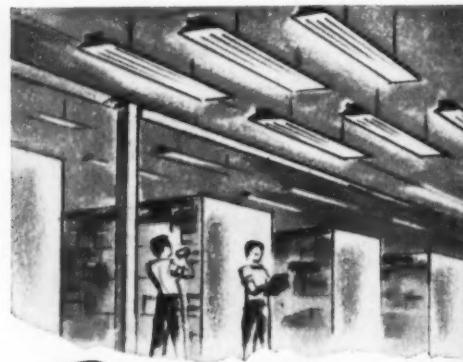
ager of the West Coast office in Santa Monica, California. Sabel formerly was general sales manager of Electronic Systems Development Corporation.

The firm of Bouillon, Griffith & Christofferson, consulting engineers of Seattle, Washington, has changed from a partnership to a corporation in keeping with the new Washington State law permitting the practice of professional engineer-

ing by a corporation. Officers and initial stockholders of the corporation, all of whom are registered professional engineers, are: Lincoln Bouillon, president; H. T. Griffith, vice president; L. F. Christofferson, treasurer; and R. H. Schairer, secretary.

Singmaster & Breyer, Inc., process engineering firm for the metallurgical, chemical, and nuclear industries and an affiliate of The

Fluor Corporation, Ltd., has announced three top management organizational changes. Byron Marquis, formerly vice president of engineering, has been appointed president of the New York City company; Frank G. Breyer, previously chairman of the board, is chairman of the advisory committee; and William H. Finkeldey has moved up from the presidency to chairman of the board.



*Built to take it...
Indefinitely!*

THE NEW
ROCKER-GLO
SWITCH

Here is a switch that can take it... and come back for more. Install Rocker-Glo in the most used and abused stations in institutional, commercial or factory building. Then watch its continuous, perfect, satin-smooth performance.

P&S Rocker-Glo switches are AC switches, designed to be used at full current ratings on tungsten filament and fluorescent loads — one does the work of two AC-DC switches for controlling fluorescent fixtures. Rocker-Glo can be used anywhere old-style toggle switches are used. Rocker-Glo is sturdily constructed. Its rugged, wall-hugging luminous rocker is not subject to breakage from accidental blows as is the case with ordinary switch handles. It's built to withstand punishment ordinary toggle or specialty switches cannot take — changes no wiring habits. Single Pole and Double Pole switches are indicating — you can tell when they're on or off.

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In Canada, Renfrew Electric Limited, Renfrew, Ontario

MAKE THE COMPLETE JOB COMPLETELY P&S



Available in Despard interchangeable type, Despard Type mounted on strap and narrow rocker for tumbler switch plates. A specification grade switch, 15 and 20 amps. 120/277 volts AC.



MARQUIS

BREYER

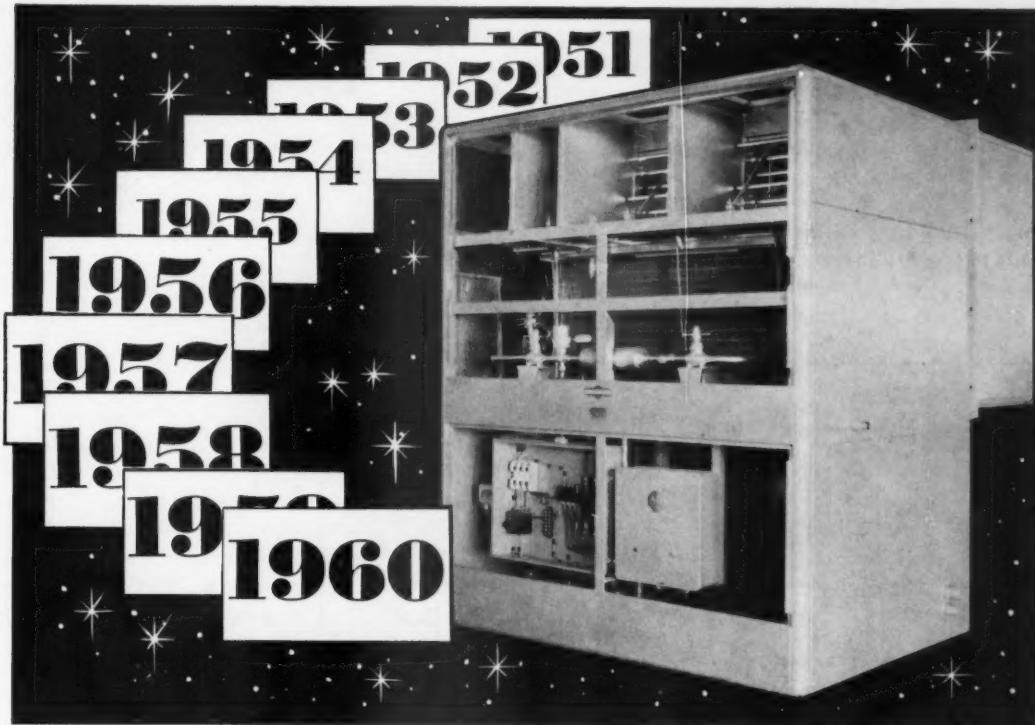


FINKELDEY

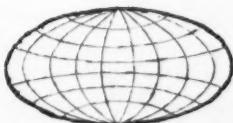
LEWIS

Brian J. Lewis, formerly traffic and transportation engineer in charge of the Seattle office of Porter, Urquhart, McCreary & O'Brien, recently joined Whipple, Murphy, Pearson & Associates, consulting engineers, of Palo Alto, California, as a partner. In his new position, Lewis will specialize in the fields of traffic, highways, planning, and feasibility studies. Lewis also is in charge of the firm's office at 403 Alaska Trade Building, Seattle, Washington.

F. Clinton Winter, Jr. has been appointed assistant to the vice president, dealing with contract administration and client relations, of Engineers Incorporated, consulting engineers of Newark, New



a decade of proven performance
in self-contained multi-zone units



Yes, for ten years, GOVERNAIR has led the way in the engineering and development of self-contained multi-zone air conditioning units.

Both the Evaporative Condenser Package (type SCMZ) and the Water Cooled Condenser Package (type STMZ) are far beyond the pioneering stage, and have been tested and proven in actual use throughout the world, under widely-varied conditions.

Available in 8 through 100 tons, every unit is "Satisfabricated" to fit individual job zone and capacity requirements . . . assembled from the finest materials and components, then thoroughly factory-tested before delivery. For complete information, please write . . .



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Jersey. For the past 20 years Winter has been engaged in a wide range of engineering projects in many areas of industry.

The firm also named C. Richard Treptow as assistant vice president dealing with contract administration and client relations.

Wayman C. Wing, formerly an associate of Seelye Stevenson Value & Knecht, consulting engineers, New York, New York, has opened

his own office at 411 Seventh Avenue, New York, New York. During his 12-year association with Seelye Stevenson Value & Knecht, Wing was in charge of the structural design of numerous buildings including schools, churches, chain stores, hospitals, apartment houses, and industrial and public buildings. He also supervised the preparation of the preliminary design of eight New York State thruway bridges and was the civil engineer-

ing designer on the grading, drainage, and layout work on Broome County Airport, New York, and Rochester Airport, New York.

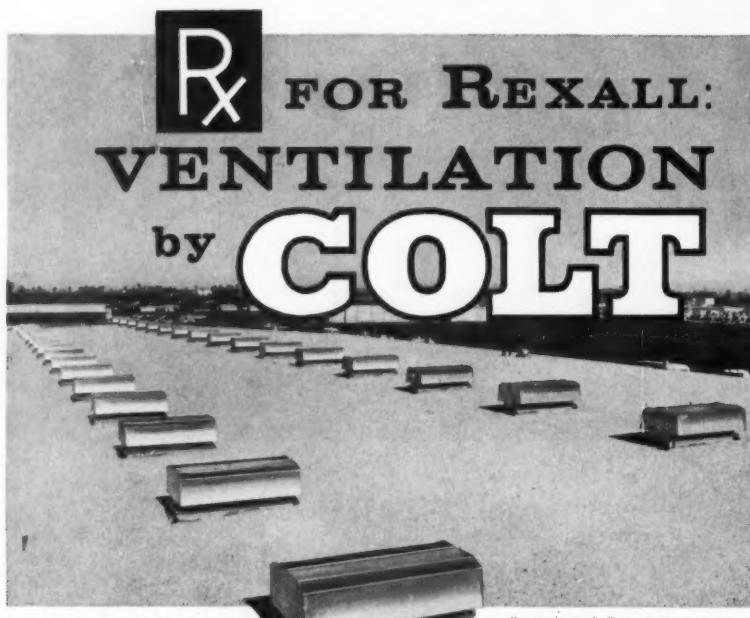
Woodward, Clyde, Sherard & Associates, consulting soil and foundation engineers of Kansas City, Missouri, has moved its office to 600 East 95th Street.

Frederic P. Wiedersum Associates, architects-engineers, has set up a government department to be headquartered in the firm's own two-story building in New York City. At the same time, a new office to service this department has been opened at 1627 K Street, Washington, D. C. Guy Rothenstein, associate of the firm, has been named supervisor of the operation. Wiedersum Associates also has offices in Trenton, New Jersey, and Miami, Florida.

Rutherford L. Stinard, P.E., consulting engineer, New York City, announces that Kenneth A. Brown and Louis J. Piccirillo have been made associates of the firm.

The officers of The Engineers Collaborative, Chicago consulting structural engineers, announce that the firm of Wiss and Associates has become a part of their organization, and that Wiss has become an executive member of TEC. Wiss is nationally known for his work in the fields of vibration and shock analysis and control, blast measurement and control, vibration isolation, and other related dynamic impact problems. He will have offices in the firm's structural model laboratory, 570 Northwest Highway, Des Plaines, Illinois.

Herbert Pomerantz has been appointed project manager for commercial and industrial designs of S. W. Brown, consulting engineers, of New York City. Pomerantz formerly held the position of group chief at Voorhees Walker Smith Smith & Haines. □



Huge battery of Colt SRC/3080 natural gravity ventilators, part of a recent installation for Rexall Drug & Chemical Co. in California

Engineers and General Contractors:
Wm. J. Moran Co., Alhambra, California,
for the new Rexall plant, Air conditioning
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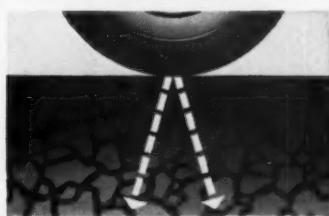
CONCRETE

Modern concrete for Kentucky's Interstate 65 south of Elizabethtown

is the pavement that is not flexible ... gives maximum strength with minimum thickness!



Concrete's beam effect distributes wheel weight over large area of subgrade, reduces spot pressures. Strength of material—not mass—carries the load, permitting minimum-thickness pavement.



Flexible pavement, by its very flexing effect, transmits load forces in almost direct line to subgrade. Excessive concentration of load force can be overcome only by building up pavement thickness.

Interstate System highways like Kentucky's Route 65 pictured here call for a pavement that is solid and unyielding.

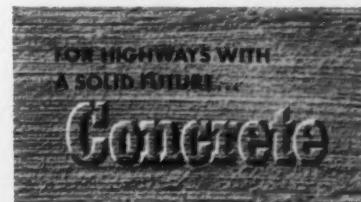
Kentucky's highway department chose concrete for this important stretch of Interstate System highway. Necessity for multiple strata construction of 2 to 3 times greater total depth was avoided.

Strength with minimum bulk is possible, of course, because concrete isn't flexible. It supports and spreads the load like a beam. Pressures on the subgrade stay permanently within safe limits.

And concrete's design efficiency assures low maintenance costs in

years ahead. In fact, maintenance costs will be as much as 60% lower than for asphalt. Only concrete enables engineers to design highways to last 50 years and more.

You can see why engineers and taxpayers agree that concrete is the preferred pavement for heavy-duty highways—especially on the new Interstate System.



PORLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete



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Steel is best for bridges...

AND THE COMBINATION OF  HIGH-STRENGTH STEEL WITH CARBON
STRUCTURAL STEEL CUTS WEIGHT, REDUCES COSTS AND INCREASES CLEARANCES

Here are three cases where the use of USS MAN-TEN Brand of High-Strength Steel in short-span bridges resulted in weight reductions up to 29% and substantial savings in cost. The depth of the stringers was reduced from 36 inches to 33 inches in some instances, by designing to permissible allowable stresses of 24,000 psi for USS MAN-TEN Steel compared to 18,000 psi for A-7 steel.

All three jobs are parts of the Penn-Lincoln Parkway East in downtown Pittsburgh. A total of 4,250 tons of USS High-Strength Steel combined with 695 tons of A-7 steel, using both strength levels as good design dictated, were used to construct these modern over-passes and elevated structures. The designer and engineers were Richardson, Gordon & Associates, Pittsburgh, and the General Contractor, Fabricator and Erector was Fort Pitt Bridge Works, Pittsburgh, Pa. Concrete Contractor: John F. Casey Company, Pittsburgh, Pa.

United States Steel makes steel of high-strength levels for a wide variety of applications: USS MAN-TEN, USS COR-TEN, USS TRI-TEN Brands (50,000 psi minimum yield point), USS "T-1" Constructional Alloy Steel (100,000 psi minimum yield strength), in addition to a complete range of carbon and stainless steels. For more information, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

*USS, MAN-TEN, COR-TEN, TRI-TEN
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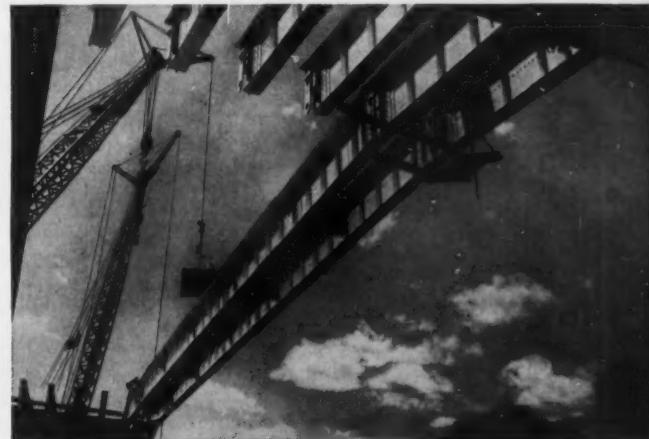
United States Steel

◀ **COST REDUCTION.** A typical 54-foot USS MAN-TEN Steel wide flange structural (33 inches deep) used as a stringer in this section costs \$41.85 less than one made of A-7 steel (36 inches deep). With 28 spans and 140 such stringers between Stanwix and Grant Streets, in Pittsburgh's Penn-Lincoln Parkway, the total saving in favor of USS MAN-TEN High-Strength Steel is \$5,859. Weight savings were 23½% in the stringers, and their depth was reduced three inches compared to the depth of the member that would have been required had A-7 steel been specified. Deflection requirements of the end cross girders in this, as well as other portions of this part of the Parkway, were such that A-7 steel was the more economical grade for these parts.

Material costs (f.o.b. mill) and weight savings calculated by United States Steel.



29% WEIGHT SAVING. This curved ramp off Grant Street has 7 spans of 65 feet and 1 span of 77 feet using 850 tons of USS MAN-TEN High-Strength Steel and 100 tons of A-7 steel. Simple rolled beams of high-strength steel were possible instead of built-up plate girders of A-7 steel. This is responsible for a large reduction in weight and cost. Again, due to deflection requirements, cross members were A-7 steel.



GREATER STRENGTH—MORE CLEARANCE. Westbound Parkway ramp near 10th Street, crossing B&O freight yards. A good application where MAN-TEN High-Strength Steel reduced the depth of the girders, providing greater clearance. This section has 12 spans: 9 simple span plate girders 130' x 66" deep and 3 anchor plate girder spans with cantilever arms 180' to 199' end to end x 66" deep. 3,100 tons of MAN-TEN Steel were used in the girders and 560 tons of A-7 steel were used for expansion dams, diaphragms and shear locks. Weight savings estimated—about 28%.

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Scraps & Shavings

Wing Rotor Power from Rivers

A Russian inventor is reported to have developed a wing rotor with a blade design which will be operative in a flow of only one meter per second. Design already is completed for a standard 300-kw station. Rotors are fastened to a metal cable which transmits the energy to an electric generator. No obstacles to navigation occur, since the rotor cable can be lowered to any depth. It also can operate in only 25 to 30 cm of water.

A Difference of Opinion

West Virginia's Turnpike is still in financial trouble. A traffic survey by the engineering firm of Wilbur Smith and Associates resulted in a January recommendation that tolls be increased to boost annual revenue about \$500,000. However, Turnpike engineers, Howard, Needles, Tammen & Bergendoff, expressed opposition to an increase in 1960. Present passenger car toll for the 88-mile distance between Charleston and Princeton is \$1.95.

School Building Boom Continues

California voters may be faced with a decision on state loans to local schools in June, when they will vote on either a \$300 million bond issue supported by the governor, or a \$400 million issue which has the blessing of school interests. In Rhode Island, the legislature is

studying a bill which would provide \$1.5 million for direct aid to school construction, with the state picking up a quarter of the total project cost. Utah, also facing school problems, is considering the doubling of the bonding capacity of local districts to meet principal payments on outstanding and any new bonds to be issued.

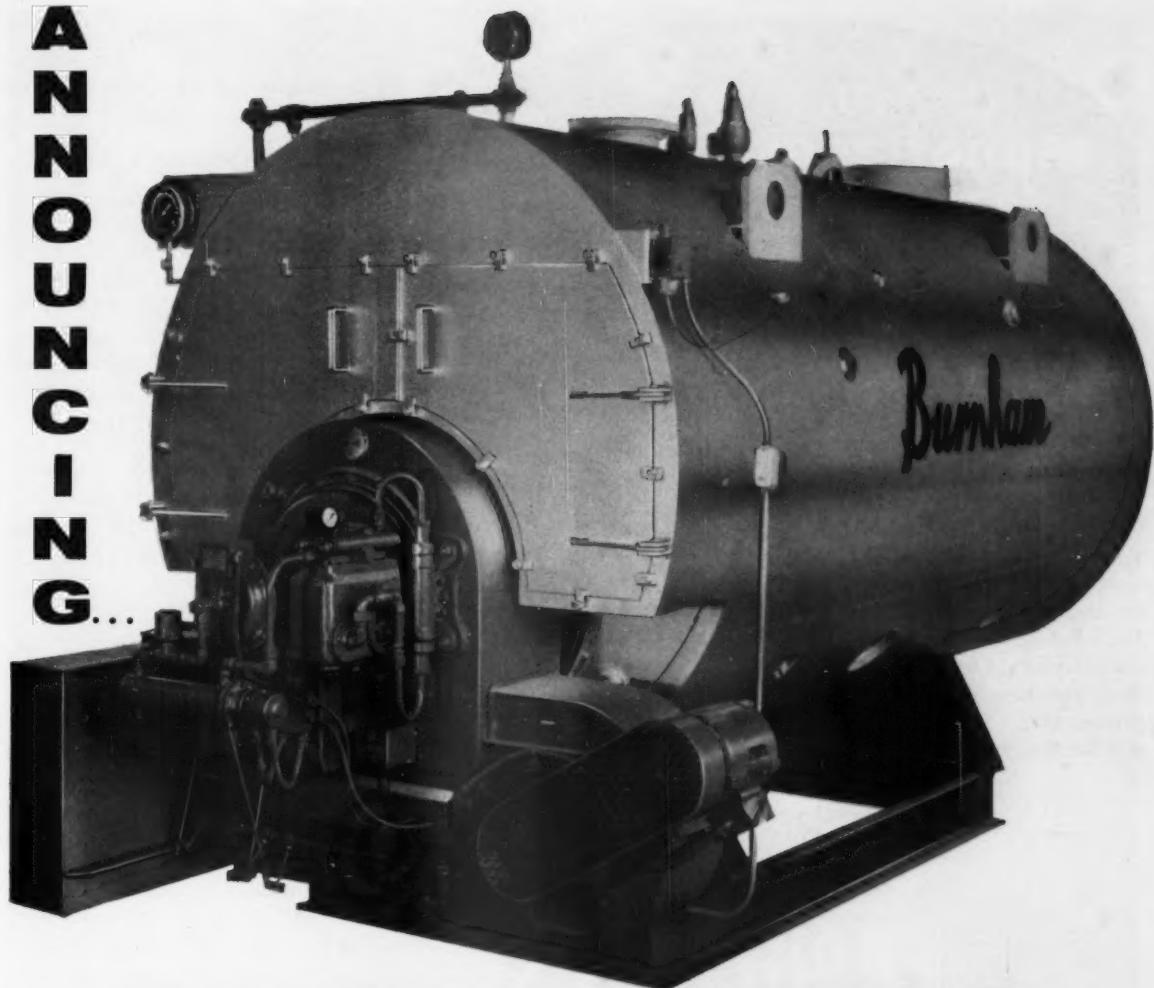
Beginning Salaries Climb

The current graduating class of Case Institute of Technology has received job offers averaging \$525 per month, a rise of \$24 over the 1959 average. Highest individual offer was made to a mechanical engineering student who will begin at \$750 per month. Graduates in electrical engineering and engineering science received the top job offers.

Indian Studies Sewage Lagoons

Muzzaffar Ahmed Mirza, assistant engineer to the Karachi Authority, is spending a year in the United States on a technical exchange program sponsored by the United States Public Health Service and the government of Pakistan. He will spend considerable time with the Metropolitan Sewer District of St. Louis, studying various types of machinery installations, use of chemicals, and new treatment methods. Of particular interest to him is the sewage lagoon for the Sugar Creek Treatment

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Plant in Kirkwood. He indicated that the low cost of this natural treatment method will result in its extensive use in India.

Inadequate Highway Lighting?

Reports from the Illuminating Engineering Research Institute's recent symposium indicate that highway lighting may be 50 percent below required levels for safe driving at 40 to 45 mph. Recommended lighting levels for safe stopping are currently set at 0.2 to 1.2 foot-candles, whereas there seems to be a definite need for 0.7 to 2.8 foot-candles. Other reports indicate a need for increased curb lane lighting and new techniques for lighting under foggy conditions.

Cold Speeds Maine Highway

In certain Maine areas on the new interstate route from Portland to Yarmouth, cold weather has aided construction by freezing deposits of marine blue clay. During the normal construction season, water may infiltrate through fine sand strata and soften the clay. When this occurs, it is impossible to operate excavating scrapers. Sometimes even big tractors and power shovels must be worked on mats.

Frost alleviates such conditions considerably. In clay cuts, for example, it has enabled the field crews to cut away the surface to subgrades and install drains without too much difficulty. The frozen crust has supported trucks carrying borrow and base materials across areas that in warmer weather would be impassable.

This spring, the field engineers hope that the natural plus artificial drainage will result in a clay surface in the cuts which will be relatively free of water and firm enough to carry the base and pavement. Until Maine thaws out, the lower the temperature, the easier the work.

New York Pollution Threat

Threats of pollution in New York City's Croton reservoirs in West-



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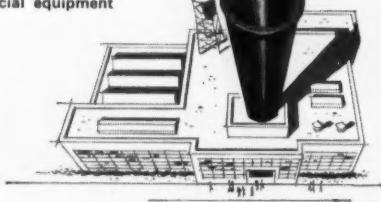


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chester County have resulted in a request for a \$206,000 engineering survey. The study would be aimed at finding out if it would be feasible to build a comprehensive interceptor system to carry off sewage and other wastes emanating from adjacent regions. The new survey would be the third stage in a program which seeks to find means of carrying away from the city's watersheds the harmful wastes that have begun to encroach on them.

Architects Gain in Baltimore

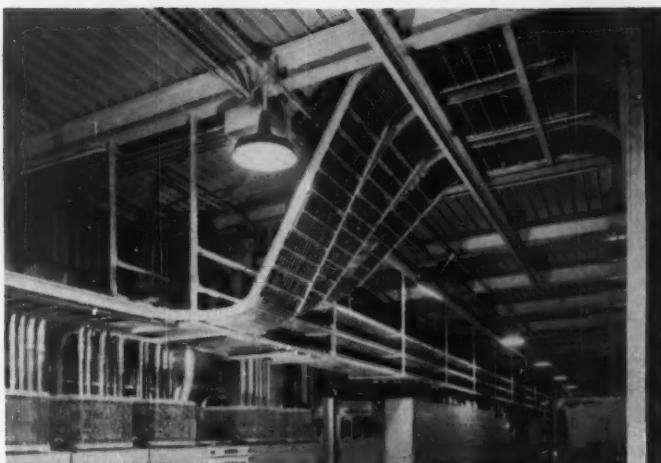
Baltimore city construction officials announced they would recommend that the city pay higher fees to private architects working on schools and other public building projects. Two new fee schedules will be proposed to the City Architectural Commission, both of which are higher than those now in effect, but lower than those which were recommended by the local chapter of AIA.

During the first two months of 1960, the Baltimore Architectural Commission appointed architects to design about \$20 million in planned city construction, mainly new school buildings. The architects are paid on a sliding scale ranging from 6 percent of construction cost on small projects down to roughly 3½ percent of construction costs for multi-million dollar buildings.

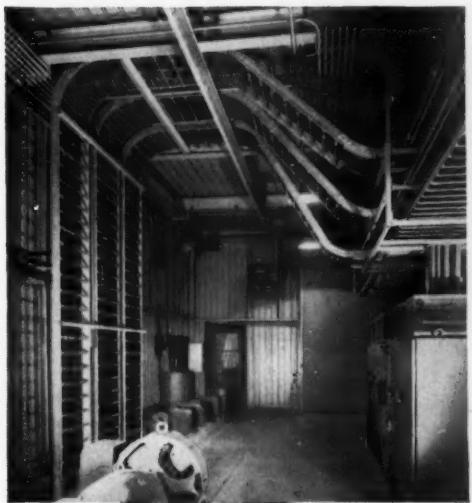
West Coast Power Intertie?

The California State Department of Water Resources has retained the Seattle engineering firm of H. Zinder and Associates to study the feasibility of an electric power intertie between California and the Pacific Northwest. Sources of power from the states of Washington and Oregon, including the Bonneville Power Administration and other public and private utility systems, are being investigated. Power needs will arise for the pumping requirements for California's huge \$2 billion program pro-

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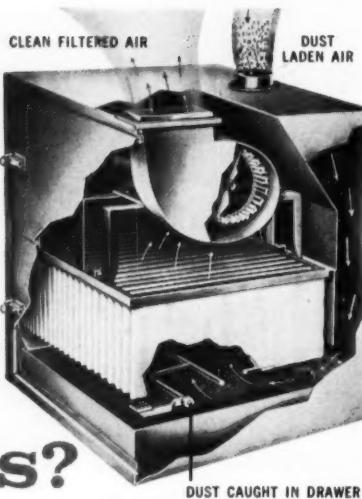
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The Mendenhall Lectures

A pioneer in the field of micro-waves, Vienna-born Dr. Ernst Weber will be the first of the Mendenhall lecturers to appear on the campus of Harvey Mudd College at Claremont, California. The lecture series is sponsored by Irvin F. Mendenhall, president of Daniel, Mann, Johnson & Mendenhall, Los Angeles architects and engineers.

Fluor Operates At Loss

The Fluor Corporation, Ltd., reported a consolidated net loss of \$229,278 for the first quarter ending January 31. Consolidated net sales amounted to about \$15½ million compared to 1959 sales of about \$21 million at January 31. According to J. R. Fluor, the first quarter loss reflects the continuing impact of a depressed domestic market for engineering-construction activity and manufactured products in the primary industries served by the company. The company expects to reverse the downward trend no later than the third quarter of 1960.

Specifications for Consultants

The Ohio Highway Department has developed a comprehensive contract "Specifications for Consulting Engineer Service" which is designed to achieve uniformly acceptable results in work performed by consulting firms. The specifications cover five major classifications, including definitions, general clauses and covenants, preliminary engineering reports, design report, and construction contract plans.

Aid to Engineering Education

Twenty-one engineering schools have benefited from Gibbs & Hill's plan for aid to engineering education. For the past four years, annual contributions have been allocated to engineering and technical schools on the basis of individu-

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al gifts by employees during the previous year. There were 43 individual gifts last year, and a total of \$1400 was available for distribution this year.

Computer Use Approved

The Board of Directors of the Structural Engineers Association of Southern California has approved the report of a committee which studied the use of electronic computers in the structural analysis

of building frames of multistory buildings. The report approved the use of computers and established rules governing their application. Daniel, Mann, Johnson and Mendenhall made the original request for a report.

Seminar for Consultants

The third annual seminar for consulting engineers will be sponsored by the University of Wisconsin Extension Division on June 2 and 3,

in Madison. In addition to faculty members, a distinguished group of consulting engineers will speak and lead discussions. The following topics will be covered in the two-day program:

"Organization and Management of a Consulting Firm," Hueston M. Smith; Smith-Hanlon-Zurheide-Levy, Inc.

"Financial Aspects of Operating a Consulting Engineering Firm," R. H. Tatlow, Pres.; Abbott, Merkt, and Co.

"Engineering Contract Documents," Art V. Maxwell, V.P.; Nielsen, Reeve & Maxwell.

"The Rebuilding of Paris," Hunter Hughes, Editor; CONSULTING ENGINEER, (Banquet speaker.)

"The Consulting Engineers Recommended Manual of Practices," Thomas R. Miles, V.P.; Consulting Engineers Council.

"Architect-Engineer Relationships," Henry A. Naylor, Jr.; Whitman, Requardt & Associates.

"Techniques of Joint Ventures," David L. Narver, Jr.; Holmes & Narver, Inc.

"Ethics - Real versus Theoretical," Joe Williamson; Williamson & Associates.

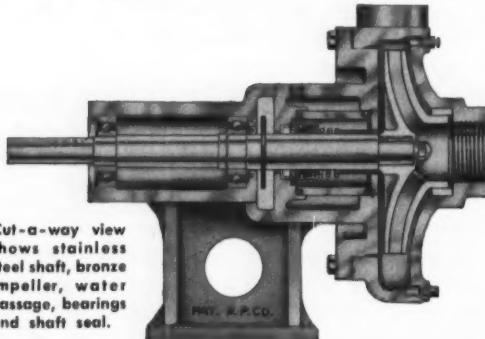
Connecticut Bridge Job

The firm of Steinman, Boynton, Gronquist & London has been retained by the State of Connecticut for the survey and design of an eight mile stretch of new express highway passing through Cheshire, Southington, and Meriden. The contract requires a total of 54 bridges, including eight stream crossings, 42 grade separations, and four pedestrian overpasses.

In the town of Meriden, the route will wind through the hills of Hubbard Park. A wide median of variable width will permit each roadway to follow the contours without marring the beauty of the park. Structures in this area will be given special architectural treatment to harmonize with the surroundings. Present plans call for a four-lane, divided highway. □

SPECIFY PACIFIC HEATEMP PUMPS FOR HOT WATER HEATING SYSTEMS

WITH WATER COOLED MECHANICAL SHAFT SEAL



Designed to meet the critical requirements of heating systems using hot water circulation.

Patented design principle incorporates built-in heat exchanger that keeps mechanical shaft seal and pedestal ball bearings C-O-O-L, while circulating high temperature water through hot water heating system.

Bulletin 1400.8 describes construction and operation. Send for your copy.

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Here's How KENNEDY'S Union Bonnet and Hex End Design Give You Easier Installation, Longer Valve Life...

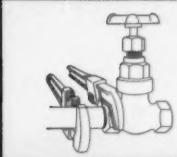
Fig. 525



Fig. 525
125-Pound SWP Bronze Gate Valve
Union Bonnet - Rising Stem - Inside Screw - Wedge Disc



KENNEDY'S wider hex ends are blended into the body, making the body and hexes one rugged unit. Thus extreme wrench pressure is absorbed through the entire rigid valve body.



On conventional valve body, hex ends protrude from the body and are connected by thin body wrists. This area, under severe wrench pressure, can distort and cause disc seating trouble.



Kennedy's Union Bonnet permits repeated dismantling for cleaning or inspection and reassembly without danger of distortion to the valve. The bronze-to-bronze construction makes a tight union for tight, leak-proof operation.



Union Bonnet Fig. 525 can be easily disassembled into its component parts to install in otherwise inaccessible places in existing lines or in new installations where space is limited.

These additional advantages make KENNEDY your best valve buy ...

Heavy Bronze Union Bonnet Ring is entirely separate from the bonnet to eliminate any possibility of springing the bonnet face when assembling or disassembling the valve.

Cylindrical Body withstands sudden pressure. Kennedy's Cylindrical Body construction resists

rupture and minimizes deflection when under severe pressure. Pressure in ordinary valve bodies tries to push the body wall out. Rupturing stresses concentrate where wall has the shortest radius. This deflection causes early failure in ordinary valves.

• YOU CAN'T BUY A BETTER VALVE THAN A KENNEDY!



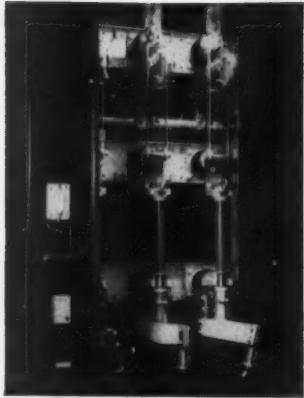
KENNEDY VALVE MFG. CO.

ELMIRA, NEW YORK

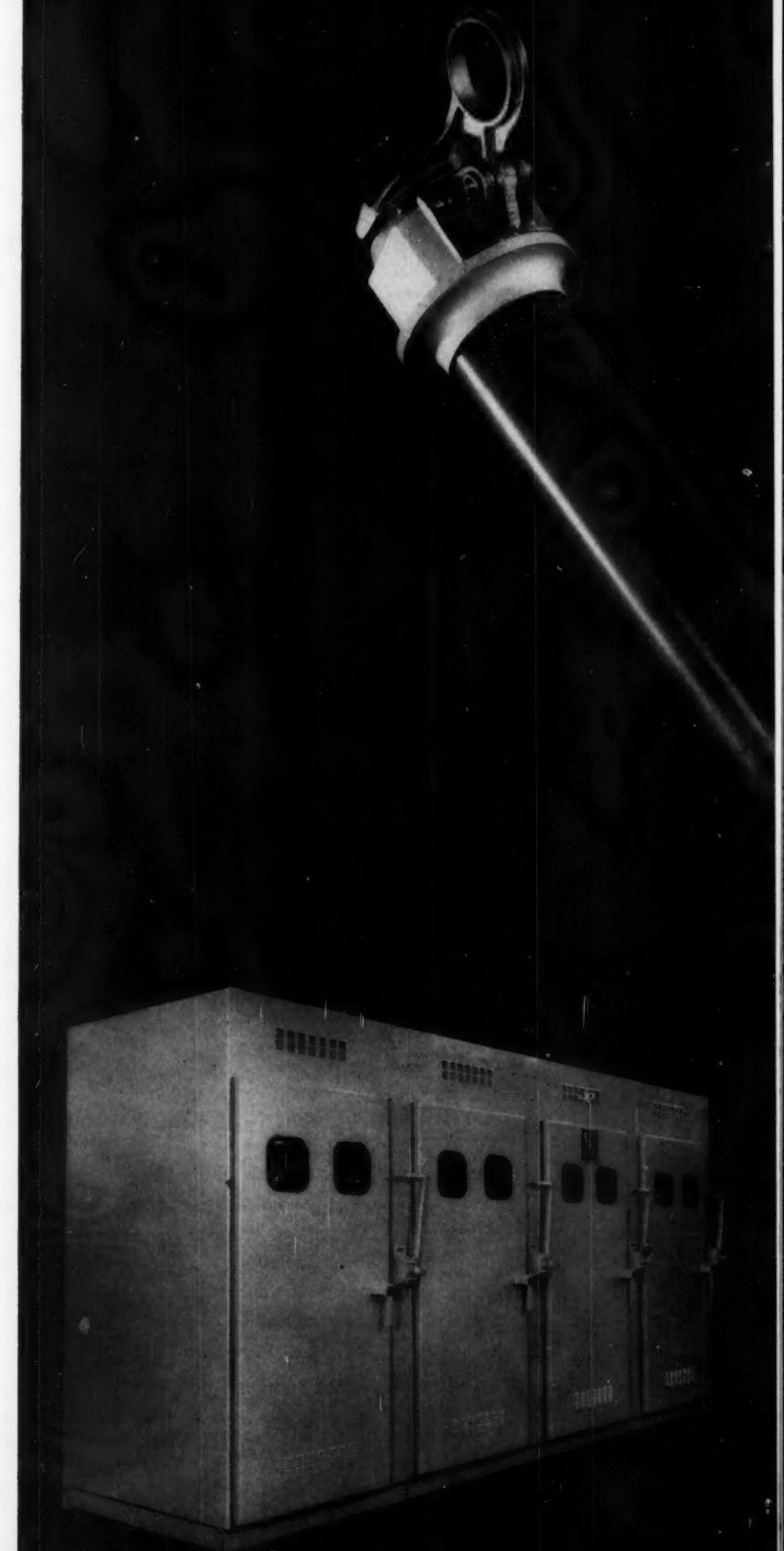
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• OFFICES AND WAREHOUSES IN NEW YORK, CHICAGO, SEATTLE, SAN FRANCISCO, ATLANTA • SALES REPRESENTATIVES IN PRINCIPAL CITIES •

SEES ALL YOUR FAULTS



Inside view of typical bay, showing load interrupter (for switching), power fuses, and out-going pothead.





A Power Fuse both senses and clears short circuits— cuts cost of metalclad switchgear 50%

With S&C Metalclad Switchgear you get dependable protection for your high-voltage power circuits at about half the cost. How? Partly through the use of S&C Power Fuses instead of circuit breakers and relaying.

The power fuse is self-sufficient. It needs no instrument transformers, no relay. There is nothing to set, adjust, test, or maintain. You don't need special equipment or skills. After the fuse clears the fault and the cause has been corrected, you simply reach for a \$13.50 refill stored in the compartment door.

Power fuses give you the protection you need against permanent destructive faults. Industrial and commercial high-voltage power circuits are not subject to transient faults (such as lightning, falling trees, wind, ice, rodents) and so don't need the automatic reclosing feature of the circuit breaker.

S&C fused interrupter gear meets the new National Electrical Code requirements for fault closing. It is available in short circuit interrupting ratings up to 500 mva at 14.4 kv, 250 mva at 4.16 kv. Continuous current ratings are 200, 400, and 720 amperes. Maximum capacity of main bus, 2000 amperes.

S & C ELECTRIC COMPANY
4436 Ravenswood Avenue • Chicago 40, Illinois
Specialists in High Voltage Circuit Interruption since 1911

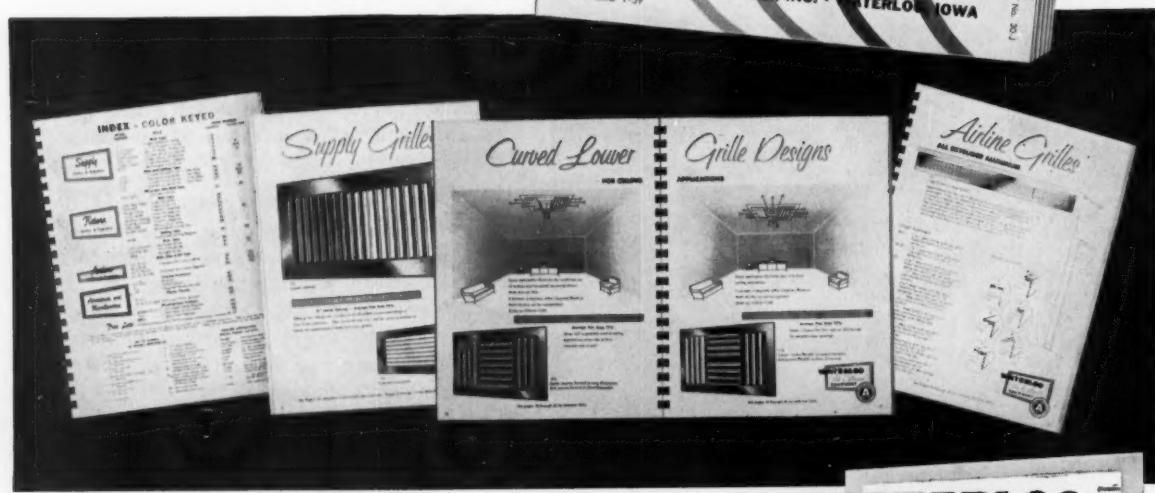


**The Producers' Council of
THE AMERICAN INSTITUTE OF ARCHITECTS
awards* Certificate of Merit to**

WATERLOO CATALOG

*Presented at the A.I.A. Convention
in San Francisco on April 18, 1960

The Producers' Council, Inc. of Washington, D.C. has awarded a Certificate of Merit in the 1960 Building Products Literature Competition to a comprehensive air diffusion equipment catalog published by Waterloo Register Co., Inc. The Award was made for "an outstanding effort in the production of informative, high quality product literature."



Write for your free copy of this comprehensive guide to the quality-built Waterloo line.

WATERLOO REGISTER COMPANY, INC.

P.O. BOX 72, WATERLOO, IOWA

WR129*

232

**WATERLOO
Air Diffusion
EQUIPMENT**



CONSULTING ENGINEER

Reporting

The New Projects

New Parking Facility Studies

A \$56,000 survey of parking facility demands and future requirements has been authorized for New Orleans by the Louisiana State Highway Director. Robert Whiteside, field engineer for Wilbur Smith & Associates, the project engineer, said the survey will develop a parking plan for downtown New Orleans with a 10-year projection.

In St. Louis, George W. Barton & Associates has been retained for a study of the financial feasibility of a proposed new municipal parking garage, to be located on a site near the Kiel Auditorium. The study will cost \$6300.

New Las Vegas Airport Facilities

Las Vegas' McCarran Field will get new facilities costing \$4.5 million, according to a recent announcement by the Clark County Board of Commissioners. Welton Becket & Associates, architects and engineers, and John Replogle, Las Vegas architect, are the designers.

Focal point of the new facilities will be the two-level hexagonal passenger waiting room. The roof will be formed of three identical thin-shell concrete segments, each describing an arc from the ground



to a peak of 40 feet and then back to the ground. The segments will be poured in place, using the same form three times. They will be joined back-to-back, leaving three sculptured spines between them at the top. One of these will lead to the ticketing building and the other two to the airline loading fingers.

The ticketing building is planned as a 500-ft long, 90-ft wide open V. Ticketing desks, baggage claim racks, and concessions will occupy the main floor, and airline office space will be provided on a mezzanine. The 68,000-sq ft structure will be of steel frame and masonry construction.

Swedish System for Suspension Roofs

The Jawerth system of building suspension roofs over prestressed steel cables has proven particularly economical for spans of over 200 feet. It was



Unusual shapes in thin-shell concrete will be a feature of Welton Becket's design for the Las Vegas Airport.

first used for a sports hall in Varnamo, South Sweden, and has been widely acclaimed. A number of similar structures are being erected throughout the world, particularly in West Germany.

The Jawerth system is based on pairs of cables braced against each other by means of zigzag shaped struts. The upper wire takes up gravitational and prestress forces, the lower one wind stresses and also prestress forces. The cables are anchored into the supporting structures or walls by means of specially designed clamps. Roofing for the structure may be of several types, depending on the degree of insulation that is desired and the climatic conditions that are to be met.

New Plant Will Have Rooftop Parking

An unusual feature of the modernization and expansion program of the Mueller Company at its Decatur, Illinois, plant is a rooftop parking area for 450 automobiles. The area will be reached via a three-lane ramp equipped with snow melting devices. The center lane will be reversible to provide two-lane up traffic in the morning and two-way down traffic in the afternoon. The \$5 million program is under the direction of Sverdrup & Parcel Engineering Company. Present plans call for bids in August, and project completion in the latter part of 1962.

Gantry Crane for Florida Power and Light

Wind loads were of primary concern in the design of this 55-ton gantry crane built by the Whiting Corporation according to specifications by the Bechtel Corporation of San Francisco. Spanning

125 feet, the five-motor crane operates completely out in the open. The 40-ft high bridge is powered by two motors, and the three-motor trolley can make a 54-ft lift. The unit was installed recently at a new steam station of the Florida Power and Light Company.

New Cleveland Offices for Austin

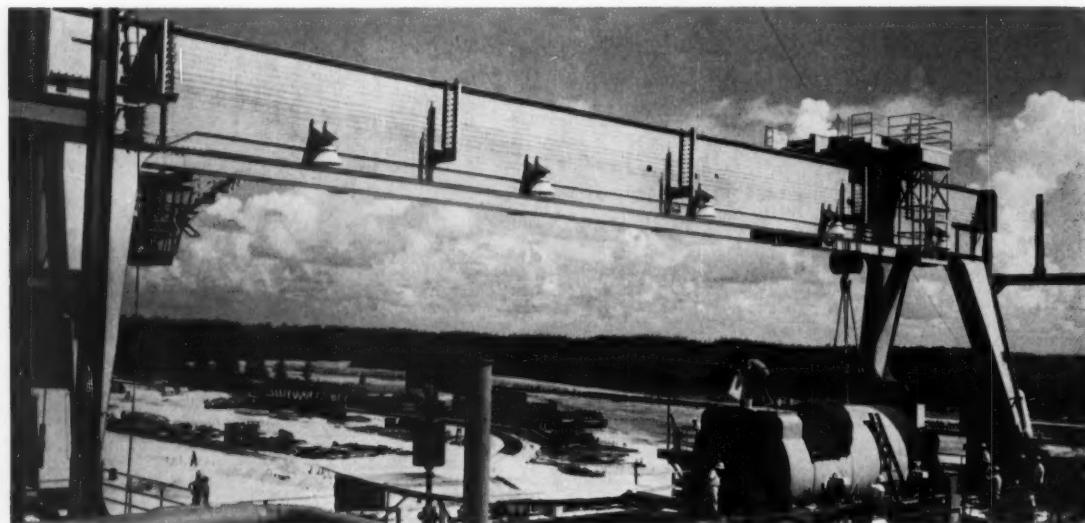
The 151-acre Severance Estate in Cleveland Heights will provide lakeside settings for a general office and research building and a district engineering building for the Austin Company. The L-shaped office building will include a 105-seat auditorium and a spacious lounge including a large display area. Air conditioning and other building service equipment will be isolated from the offices in a separate one-story structure supporting the outer end of the research wing.

The 20,000-sq ft district headquarters building will be entirely without interior columns. Free standing steel columns around the exterior will support 100-ft H-section trusses completely spanning the 90-ft by 210-ft interior, plus a portico which will serve as a sunshade around the perimeter of the building.

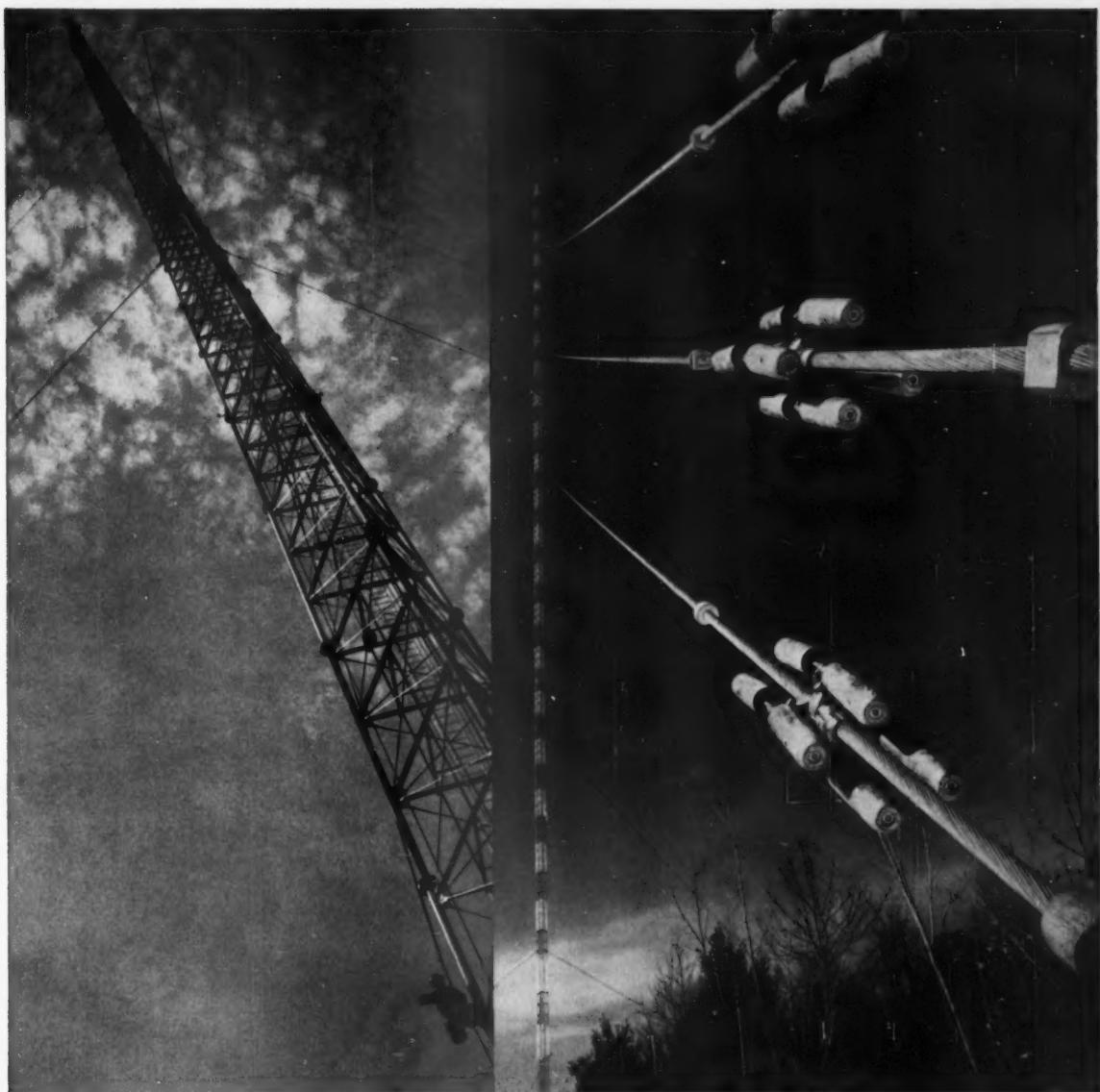
Largest Prestressed Concrete Bridge in U. S.

The \$2 million Oneida Lake Bridge on New York's Interstate Route 505 is a 320-ft span structure of prestressed concrete construction. It is reported to be the longest such bridge in the United States.

The bridge consists of two separate parallel structures, carrying three lanes of traffic in each direction. Each structure is made of 12, 146-ft can-



Bechtel Corporation specified this 125-ft span gantry crane for Florida Power and Light Company steam plant.



WGAN-TV transmitting tower, Portland, Maine. Held aloft by Roebling bridge strand.

18 "Good Guys" From Roebling Hold World's Tallest Man-Made Structure Proudly Erect

This is just about as high as you can go without a launching pad. This KIMCO tower was designed, fabricated and built by Kline Iron & Steel Company, Columbia, South Carolina, for WGAN-TV, Portland, Maine. It reaches 1619 feet into space. Man has yet to go higher and still be anchored to Mother Earth.

Holding this "air-borne" giant up there are eighteen prestretched galvanized guys, made of Roebling bridge strand at their plant in Trenton, New Jersey. These guys measure some four and a half miles in

length. Other breath-taking statistics are: 520,000 lbs. of steel in the tower and the longest vertical lift elevator ever constructed. As for nuts and bolts — there are 13,400 of them.

There's only one place to go when you have a guying problem and that's to Roebling's. Our experience and facilities for solving all types of suspension problems and in meeting the soaring needs of broadcasters everywhere are unlimited. Write Bridge Engineering, John A. Roebling's Sons Division, Trenton 2, N. J.

Strand Dia. (Inches)	Total Length (ft.)	Average Length Each Guy
3 @ 1-1/4	2025	675
3 @ 1-5/16	2370	790
9 @ 1-7/16	13065	3 @ - 970 3 @ - 1505 3 @ - 1880
3 @ 1-9/16	5040	1680

Designed, fabricated and erected by Kline Iron & Steel Co., Columbia, South Carolina.

ROEBLING

*Branch Offices in Principal Cities
John A. Roebling's Sons Division
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Now...One Source for Timing Controls and Magnetic Contactors



With Zenith Equipment you can time your heavy load circuits and get both the control timer and the contactor from one source. Equipment can be mounted in the same cabinet for convenience and compactness. This saves expensive interwiring in the field.

Typical applications are parking lots or field lighting (time switch and contactor) and arc lamp control (interval timer and contactor).

Write for 64-Page
Engineering Reference Catalog 18-A



ZENITH ELECTRIC CO.

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See Classified Directory for Name of Factory Representative

just ONE
heavy duty unit services up to 19 MACHINES

DUSTKOP
STOPS DUST

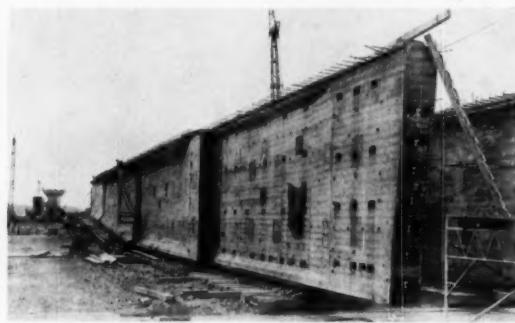
In the complete line of Aget Dust Collectors there are sizes that will service from one to nineteen machines—large or small. Some exhaust cleaned air externally . . . others clean and recirculate air within your plant. Write for illustrated folder . . . today.

46 Standard Models—Ready to Use

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tilever girders which carry five, 231-ft girders hung between them. Under live load this becomes a three-span continuous structure with continuity achieved by post-tensioning transversely at the ends of the cantilever. All members are post-tensioned concrete monoliths.

Use of Plastiment admixture in the concrete facilitated the casting of the huge girders by keep-



Interior girder for the largest prestressed concrete bridge in the U. S. is 146-ft long and 13½-ft high.

ing the concrete plastic until each 110-cu yd cantilever girder was cast. Uniformity in the concrete was maintained by varying the admixture to meet temperature conditions, thus achieving good workability for filling the small voids between the heavy reinforcing and tendons and accelerating strength gain to maintain the production rate of two girders per week.

Casting beds were designed so that the 240-ton cantilever girders could be moved across them with ease out over the abutment and pier. There are 20 tendons in the exterior girders and 28 in the interior. Eight of the tendons in each girder were tensioned before moving. Final tensioning took place after the girders were set in place.

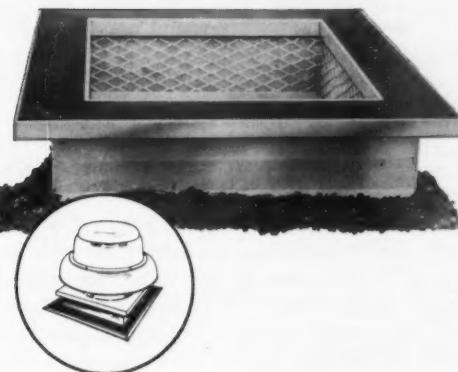
Summers, Nunninger & Molke of Albany, New York, was the consultant on the project, with construction handled by Terry Contracting, Inc. The bridge is being built under the direction of the New York State Department of Public Works, and is scheduled for 1960 completion.

Nervi's New York Bus Station

The \$13 million George Washington Bridge Bus Station will feature New York's first example of the work of Dr. Pier Luigi Nervi. The Station's concrete roof will be made up of 26 triangular sections, 14 of which slope upward from a row of columns in the center of the building. Each triangular 92-ft by 66-ft section will be made of 36 precast panels.



THE
FIRST TO
CURB ROOF
EXHAUSTER
NOISES
WERE
ENGINEERS
AT PENN!



*Penn's
SONOTROL CURB for all
roof ventilator installations
provides 3 IMPORTANT BENEFITS
to the Specifying Engineer*

Putting the curb on prevailing problems that accompany roof ventilator installations was no easy task. Roof fan sounds had to be hushed. Field constructed curbs were often haphazardly put together; they overloaded roofs and lacked dimensional coordination for ventilators and dampers. But, engineers working at Penn developed the industry's first solution . . . the *Sonotrol Curb*!

EXTRUDED ALUMINUM, an exclusive in Penn's Sonotrol design features structural "I" beam lifetime construction; reinforced seamless outside wall; loading capability of more than 700 lbs. per lineal ft. with a minimum safety factor of 2.5; provides stabilized dimensions for all dampers and ventilators . . . and everything fits!

ACOUSTICAL-THERMAL INSULATION reduces decible build-up of exhauster at the source; attenuates resonance and reverberation; minimizes sone values; no reduction in air movement.

SELF-FLASHING eliminates the problem of field flashing over the Curb; installation is simplified; flashing flange incorporates V-groove serrations for maximum gripping power.

Get complete facts now on how Penn Ventilator can be your one source for the universally accepted Sonotrol Curb, Damper and Ventilator. Contact your local representative or write direct.



*A leading manufacturer of Powered and Gravity Roof
Exhausters and Accessory Equipment for over 30 years.*

Charter Member of AMCA

Penn Ventilator products are available throughout the Free World.
One of many direct factory representatives at your service:
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HORNFLEX

Sealant...



for all the wide open beauty of curtain wall design...
with none of the weather sealing problems

Hornflex Sealant compresses, stretches and flexes with wall movement—yet keeps a solid weather seal at all temperatures. Bonds lastingly to aluminum, glass, steel, concrete and stone to form a watertight seam that stays put.

Hornflex Sealant also has many uses in swimming pool, highway and bridge construction. Write for 8-page catalog, Dept. CE-144.



A. C. HORN COMPANIES

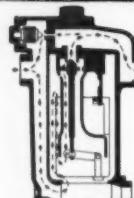
Subsidiaries & Divisions

Sun Chemical Corporation

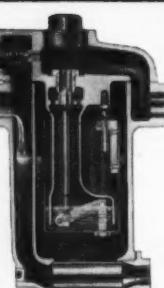
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Plants in: ATLANTA • CHICAGO • HOUSTON • DENVER • LOS ANGELES
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Sales offices and warehouses throughout the United States and Canada

Now—A Steam Trap that Adjusts Automatically to Every Operating Condition!



Warm-up speeded by discharge through bypass as well as main orifice.



In-line installation.
All parts serviced without removing body from line.

AUTOMATICALLY REGULATES FOR FASTER WARM-UP AND TO KEEP OPERATING TEMPERATURE AT PEAK HEAT

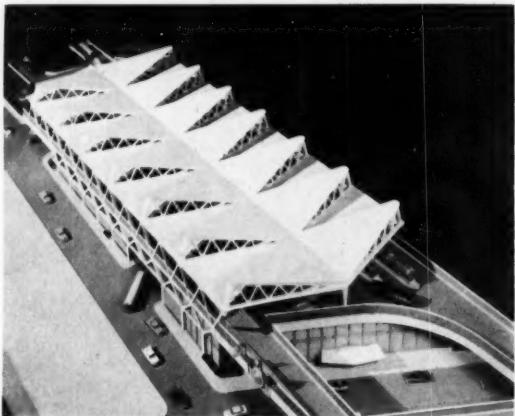
Proven bucket design with built-in accessories. By-pass thermostat increases discharge for warm-up and overload conditions. Thermostat compensated to operate at 10° below saturated steam temp. Wright-Austin Airxpel principle provides for mechanical discharge of air after Thermostatic by-pass has closed.

WRITE FOR BULLETIN 808

WRIGHT-AUSTIN COMPANY

3245 WIGHT STREET • DETROIT 7, MICH.

The sides of the raised roof sections and of the bus station itself will be exposed precast concrete structural members forming openings to facilitate



George Washington Bridge Bus Station is New York's first example of the work of Dr. Pier Luigi Nervi.

ventilation of the bus platforms and the expressway beneath the building.

The new station is a part of the George Washington Bridge six-lane lower level project. It will replace and consolidate bus operations now being handled by scattered terminals and sidewalk stations in the vicinity, and will furnish New Jersey-New York commuters with convenient modern facilities, including an underground passage to the New York City subway system.

Japanese Growth in Petrochemicals

Stone and Webster Engineering Corporation has been engaged to design and assist in the engineering and construction of a second ethylene plant for Mitsubishi Petrochemical Company Limited. Scheduled for 1961 completion, the new plant will be located at Yokkaichi, near the industrial seaport of Nagoya. Both plants will be producing for the polyethylene plastic industry. During the past four years Stone and Webster has been engaged in design and construction of six other plants for the production of petrochemicals.

Portable Power Reactor for the Arctic

Designed for remote installation, a new portable power reactor was recently shown at the Dunkirk, New York, plant of Alco Products, Inc. The new unit includes 10 skids which hold all station generating equipment from the reactor vessel to the turbine generator, as well as switchgear and the

HOW DOREX AIR RECOVERY annually cuts air conditioning costs by 78%

Over a 20-year period, the dollar difference is incredible, the penalties of owning and operating cost are tremendously reduced... if an air conditioning system uses DOREX to recover already conditioned air rather than use 100% outside air.

ESTIMATED DIFFERENTIAL OF OWNING AND OPERATING COSTS,
OUTDOOR AIR vs RECOVERY AIR FOR 1000 CFM



DOREX is designed in two basic types—C Cells and H Canisters. Because of their arrangement flexibility, canisters are especially suitable where installation space is limited or irregular.

ITEM	ANNUAL FIXED CHARGES	OUTDOOR AIR	RECOVERY AIR
1. Amortization, 20 years, cost per year.....	\$ 78.10	\$ 17.50	
2. Interest rate, 4 percent $(20 \text{ yr} + 1)/(2 \times 20 \text{ yr}) \times 0.04$ X initial cost.....	32.00	7.35	
3. Taxes and insurance (neglected).....	0.00	0.00	
4. Total annual fixed charges.....	<u>110.10</u>	<u>24.85</u>	
ANNUAL MAINTENANCE COSTS			
5. Repairs, refrigerating equipment \$1.20 per ton.....	4.56		
6. Refrigerant 0.44 per ton.....	1.67		
7. Oil and grease 0.12 per ton.....	0.46		
8. Repairs, heating gross.....	<u>5.00</u>		
		11.69	
ANNUAL SERVICE COSTS			
9. Electric power, refrigeration $(0.746 \times \text{hp} \times \text{cooling hours})^*$ = 3220 kw hr.....			
10. Cost of electric power 1.5¢ per kw hr.....		48.20	
11. Refrigeration power costs (Items 9 and 10).....			
12. Water at 11 cents per 1000 gal (neglected with cooling tower).....			
13. Heat requirement $4.5 \times 1000 \times 11.7^{**} \times 2200/\text{e} = 165,000 \text{MBtu}$			
14. Gas cost, \$1.00 million Btu.....			
15. Heating cost (Items 13 and 14).....	165.00		
16. Recovery fan power, $0.0001573 \times 1000 \text{ head} = 0.063 \text{ hp}$			
17. Recovery fan power, $[0.746(16)(2200 + 810)]/\text{e} = 188 \text{ kw hr}$			
18. Recovery fan power costs (Items 10 and 17).....			2.82
19. Labor to change recovery cells.....			2.00
20. Freight to ship used and recharged units.....			10.00
21. Regenerate, recover cells.....			35.00
	<u>213.20</u>	<u>49.82</u>	
SUMMARY			
Annual fixed charges.....	110.10	24.85	
Annual maintenance costs.....	11.69		
Annual service costs.....	<u>213.20</u>	<u>49.82</u>	
Total annual owning and operating costs.....	334.00	74.67	
Annual savings with air recovery.....	<u>260.32</u>	<u>334.99</u>	
	334.99	334.99	

*Efficiencies are taken in items 9 and 13 as 70 and 75 percent respectively.

**Difference in enthalpy, Btu per lb of dry air, between inside and outside, for average winter conditions.

From a paper by Warren Viessman, Heating, Piping & Air Conditioning—Sept. 1959

By recovering used, already conditioned air, extracting from it the accumulated impurities, and converting it to original freshness, DOREX brings about maximum economy in air conditioning. Detailed information on the unique DOREX process and equipment is available. Simply request—on your letterhead, please—Bulletin 108A and "Air Conservation Engineering". Contact the representative near you or write to Connor direct.

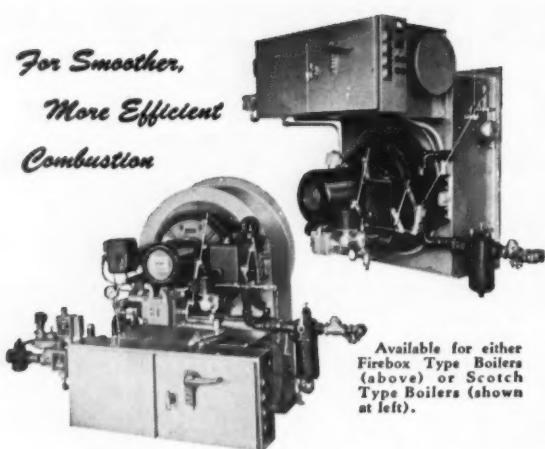
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...the most experienced professionals in air recovery and purification.

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CORPORATION
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air recovery

*For Smoother,
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(above) or Scotch
Type Boilers (shown
at left).

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For firing with Oil only . . . Gas only . . . or Combination Oil or Gas. Wired, tested and completely assembled at the factory ready for easy, inexpensive attachment to any boiler or heat receiver. They provide smoother, more efficient combustion regardless of stack conditions and firebox pressure variations. Powered by the famous Johnson Mod. 53 Burners, these "packaged" units are available for any heating need, in sizes from 28HP to 560HP.



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Dependable Accuracy . . .
with TRERICE

DIAL THERMOMETERS

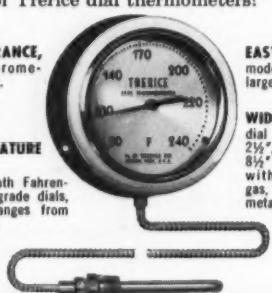
If you are after precise, dependable temperature indication, take a close look at these high-quality features of Trerice dial thermometers!

NEAT APPEARANCE,
distinctive chrome-plated dial ring.

EASY TO READ,
modern aluminum dial,
large figures.

WIDE TEMPERATURE RANGES,
available in both Fahrenheit and Centigrade dials,
temperature ranges from -100° to 1000° F.

WIDE VARIETY,
dial available in 2",
2½", 3½", 4½", 6",
8½" and 12" diameters
with mercury, vapor,
gas, solid liquid or bi-metal actuation.



All the many other standard and special option features of Trerice dial thermometers are contained in Bulletin No. 500-M. Write for your copy.

Send Bulletin 500-M.

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Detroit 16, Michigan

control console. The plant breaks down into 27 air transportable packages. The first installation is



New portable power reactor will be located on the Greenland Icccap in a roofed trench of this type.

destined for Greenland, where low temperature will require a condenser-cooling system using air and ethylene-glycol.

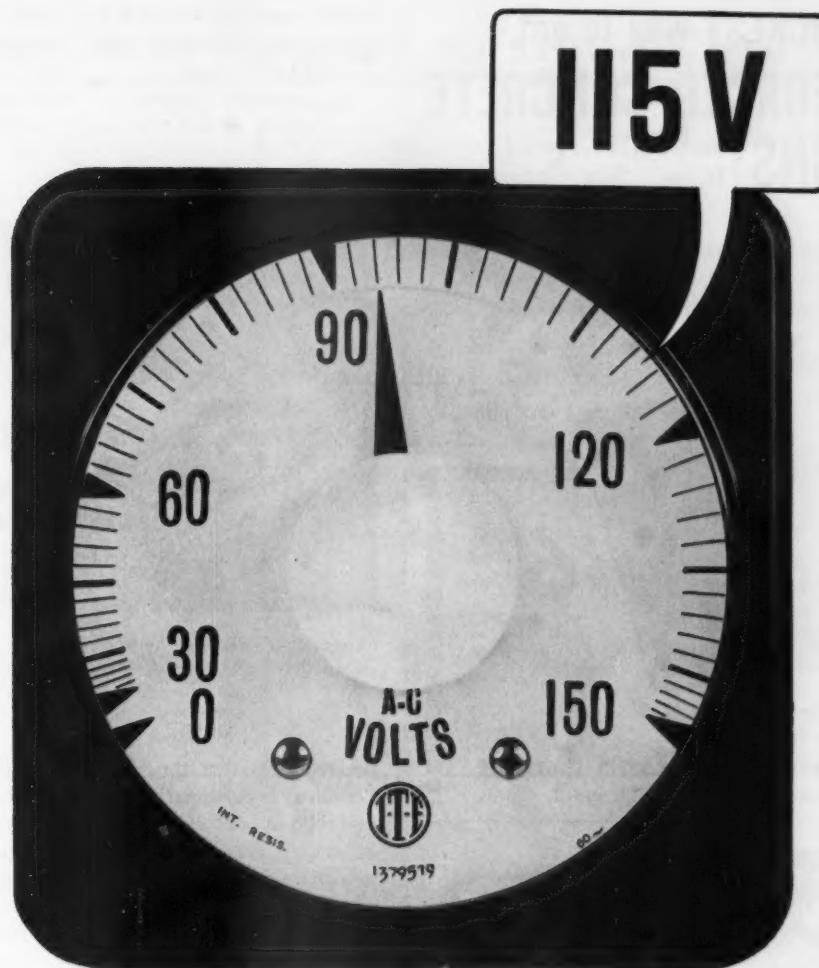
Master Plan for Albuquerque Airport

Preliminary reports are due in mid-June and final recommendations in September on the master plan being developed for Albuquerque's Kirtland Field. The project is a joint venture of Porter, Urquhart, McCreary and O'Brien, Los Angeles engineers-architects, and William Burke, Jr., architect.

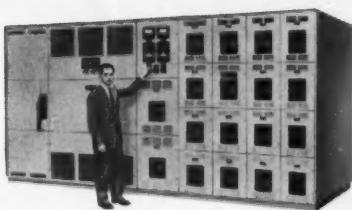
Yugoslav Hydroelectric Power Station

Two of a total of seven sections of the Perucica hydroelectric power station, near Niksic in the republic of Montenegro in Yugoslavia, are ready to go into operation. A combination of high precipitation and concentrated falls, with extremely pervious geological conditions, made this project an interesting and difficult feat of engineering.

To facilitate power production, it was necessary to construct a series of accumulation basins involving many dams and locks. The retention potential of these basins is dependent on the successful grouting of the adjoining limestone which has a deep carstification penetration. Their design re-



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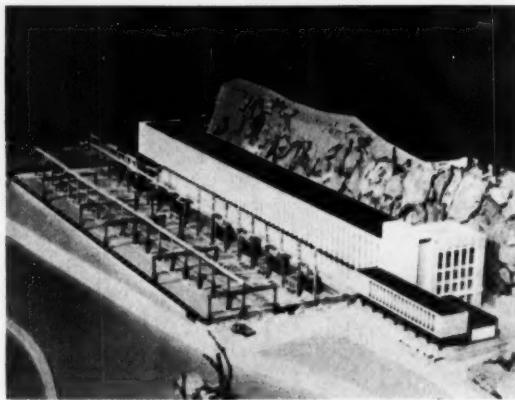
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quired extensive research and study by the engineering firm "Energoprojekt" Enterprises, which is located in Belgrade.

Accumulation basins are interconnected by a canal system with a total length of 15 miles. From



Yugoslavia's Perucica hydroelectric power station was constructed in spite of many geological problems.

the canal system the water is conducted to the Perucica hydroelectric power station through a two-mile tunnel and a gated pipeline about 120-miles long. It is anticipated that total annual electric power production will eventually be 1 billion kwh when the seven producing units are in operation.

All the building work on the Perucica hydroelectric power plant project was carried out by Yugoslav civil contractors. The hydraulic structure was produced in Yugoslavia, as well as the turbines and some of the pressure piping.

Rubber Joints for Prestressed Taxiway

Lemoore Naval Air Station has incorporated 24 rubber joints that contract and expand like bellows in a new prestressed concrete taxiway. Extending 75 feet across each end of the 500-ft long section, the joints can absorb up to 3 inches of movement caused by temperature changes. Whether expanded or contracted, the rubber joints remain level with the surface of the concrete. The B. F. Goodrich product has been used previously in highway construction.

Detroit's New Civic Center

Cobo Hall and Arena, a part of Detroit's \$112 million Civic Center, will be opened this fall, with full operation scheduled for 1961. The architect-engineer firm of Giffels and Rossetti has been at work on the project since 1951, aided by an advi-

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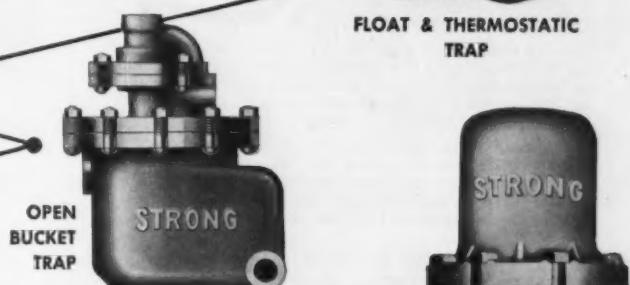
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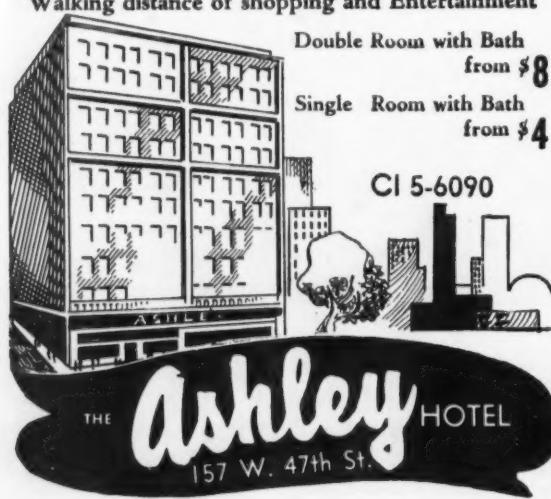
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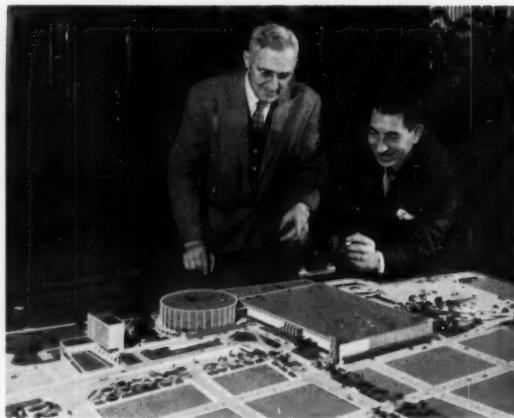
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sory committee which was originally appointed by the late Mayor Albert E. Cobo.

The huge exhibit hall has been designed with unusually high floor strength, and limited areas are



Bertram Giffels and Louis Rossetti discuss Cobo Hall and Arena design for Detroit's new civic center project.

able to handle loadings up to 2000 lbs per sq ft. The building rests on 4500 cast-in-place concrete piles, driven to an average depth of 100 feet. The largest pile grouping was made up of 29, 100-ton capacity piles.

Unusual rooftop parking is provided via a triple-lane helical ramp. Additional garage and surface lot parking is provided. Within the structure, 2200 automobiles can be accommodated.

Slipform-Lift Slab Construction Combined

San Francisco's 1800 Pacific Avenue apartment building, designed by August E. Waegemann, consulting engineer, and Herman C. Bauman, architect, combines lift slab and slip form methods of construction in a 13-story structure. Three access towers were constructed first, using slip forms. They are designed to resist all lateral forces in the building. A huge traveling crane with a lift capable of clearing 10 stories was used to place concrete.

Twelve floor slabs and the roof slab were cast in place at ground level. These prestressed slabs then were lifted into place around the towers, using conventional lift slab methods. The combination of the two construction techniques cut construction time by about 30 percent.

Bridging the English Channel

Just as enthusiasm has started to grow for the reactivation of the old scheme for a tunnel under

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the English Channel, a 21-mile bridge has been proposed. Its backers, Dorman Long Ltd of Great Britain, Merritt-Chapman and Scott Corporation of the U. S., and Francaise d'Enterprises of France, claim that while the bridge might cost twice as much as the tunnel, it could handle more traffic and present fewer problems of maintenance. The 110-ft wide structure would require about 150 piers spaced 740 feet apart except for two 1500-ft spans which would provide clear navigation channels.

Ecuador's Highway Program

Some 85 miles of roads on the eastern slopes of the Andes will be included in a \$14 million, 350-mile road program for the Republic of Ecuador. Running through largely unexplored territory to the headwaters of the Amazon River, the new road system will provide access to Brazil for Ecuadorian potatoes and other crops.

An aerial survey is already under way by Rader and Associates, and a complete engineering study and report will be submitted to the World Bank as the basis for a loan request to help in financing the project.

Highest Arch Dam in U. S.?

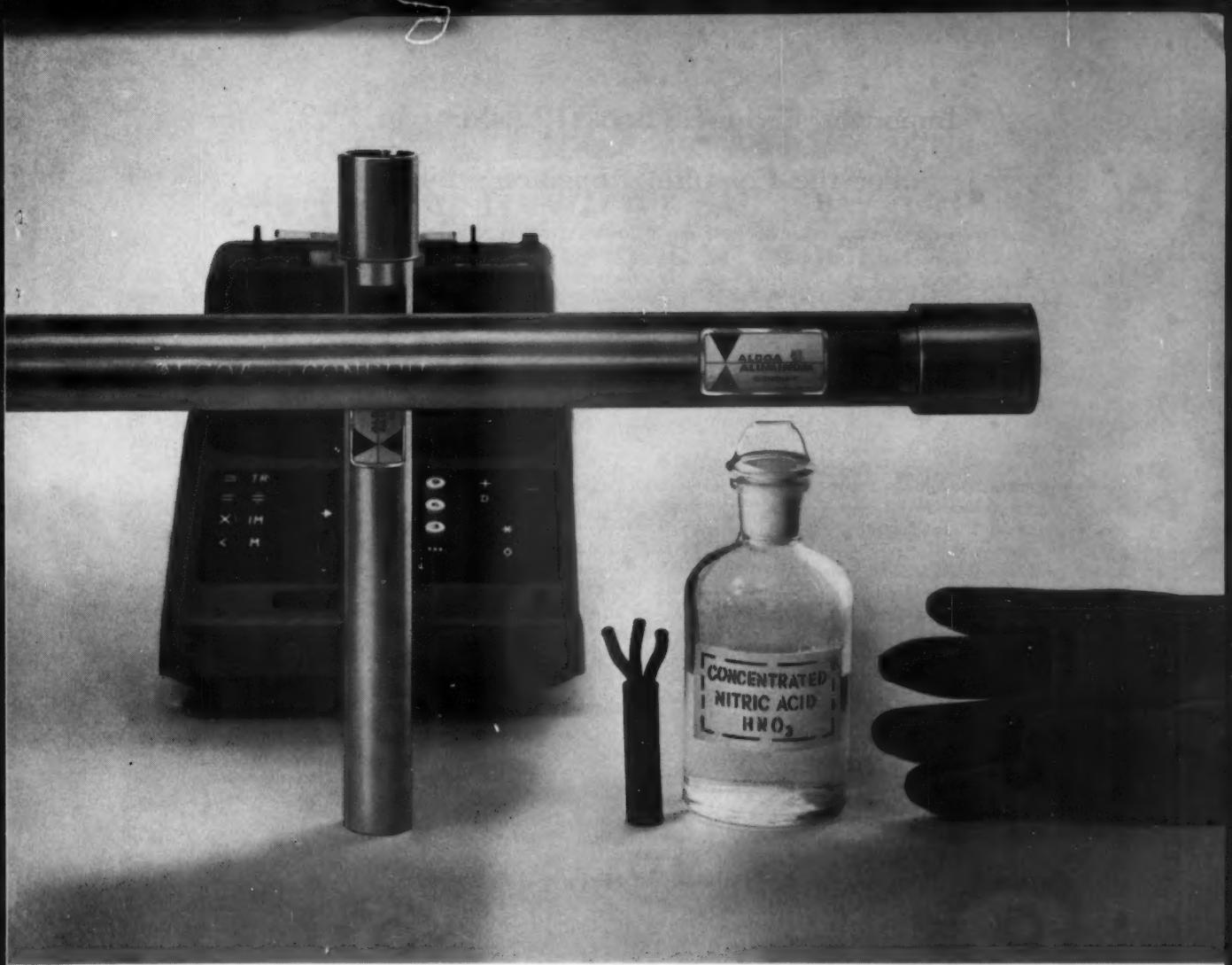
A proposal by Pacific Northwest Power Company for a high Mountain Sheep Dam on the Middle Snake River was approved by the Oregon State Water Resources Board. It is expected that the State Hydroelectric Commission will follow the board's recommendation that a license be issued.

The dam is to be located on the Oregon-Idaho border, some 50 miles south of Lewiston, Idaho. It will be 690-ft high, making it the highest arch dam in the nation. The dam's reservoir will reach 59 miles back along the Snake to the Idaho Power projects of Oxbow, Hells Canyon, and Brownlee. Pacific Northwest estimates that it will take five years to build the dam.

Boston Common Will Get Garage

Sale of an issue of \$9.6 million in garage revenue bonds of the Massachusetts Parking Authority paves the way for groundbreaking ceremonies for the controversial Boston Common underground garage. The project will be built by the Foundation Company, engineers and contractors, in cooperation with Welton Becket and Associates, architect-engineers, and Cosentini Associates, engineers.

The new facilities will be built in two stages. The first garage, bounded by Beacon and Charles Streets, will have parking facilities for 1500 cars on three levels. This phase will cost \$7.5 million. Construction of the second stage is not yet scheduled. A topographical plan of the area has been drawn so that it can be restored. □



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Air Pollution Control, by W. L. Faith; John Wiley & Sons; 259p.; \$4.95. Fairly nontechnical, illustrated presentation of basic facts to be considered in any air pollution control program, voluntary or legal.

Aluminum Construction Manual, published by the Aluminum Association; 389p.; \$3.09. Reference manual covering all important structural uses of aluminum and new data on alloy 6061. *Analysis of Pipe Structures for Flexibility*, by John Gascoyne; John Wiley & Sons; 181p.; \$7.50. Practical handbook of piping design data based on American and British standards and safety codes, with discussion of operations at temperatures above 1200 F. *Chemical Engineering Economics*, 4th ed., by Chaplin Tyler and C. H. Winter, Jr.; McGraw-Hill Book Co.; 192p.; \$7. Includes discussion on investment, cost, price, profit, and management that should help engineers determine the probable economic value of any proposed project.

Engineering Education in Russia, by S. P. Timoshenko; McGraw-Hill Book Co.; 47p.; \$2.75. Personalized account of the history and development of Russian engineering education.

Feedback Control Systems, by J. C. Gille and others; McGraw-Hill Book Co.; 813p.; \$16.50. Comprehensive reference text covering analysis, synthesis, and design of both linear and nonlinear servomechanisms. Has polyglot glossary; annotated bibliography. *Ground Water Hydrology*, by D. K. Todd; John Wiley & Sons; 336p.; \$10.75. Presentation of the fundamentals of ground water hydrology — occurrence, movement, hydraulics, wells, quality, development, investigation, recharge, sea water intrusion, legal aspects, and model studies.

Handbook of Air Conditioning, Heating and Ventilating, Clifford Strock, editor; Industrial Press; \$15. Practical reference for engineers specializing in this field.

Hyperstatic Structures; An Introduction to the Theory of Statically Indeterminate Structures, Vol. I, by J. A. L. Matheson; Academic Press, Inc.; 474p.; \$15.50. Family relationships among all the various explanatory techniques and theorems in this field are discussed. Applications of these discussions will be emphasized in Volume II.

Industrial Building Details, 2d ed., by D. F. Roycroft; F. W. Dodge Corp.; 356p.; \$12.75. Over 1500 detail drawings of sections of modern industrial buildings including walls, windows, roofs, floors, ventilators.

Introduction to the Dynamics of Framed Structures, An, by G. L. Rogers; John Wiley & Sons; 355p.; \$10.25. For engineers specializing in bridge and building design who have a background of elementary differential equations and a knowledge of framed-structure statics.

Inventions, Patents, and Their Management, 4th rev. ed., by A. K. Berle and L. S. De Camp; D. Van Nostrand Co., Inc.; 602p.; \$12.50. Problems, procedures, and actual cases are cited and discussed.

Machinery's Handbook; A Reference Book for the Mechanical Engineer, Draftsman, Toolmaker, and Machinist, 16th ed., by E. Oberg and F. D. Jones; Industrial Press; 2104p.; \$11. Standard handbook including discussion on gears, small tools, speeds, materials, mathematics, and other pertinent topics.

Modern Air Conditioning, Heating, and Ventilating, 3rd ed., by W. H. Carrier and others; Pitman Publishing Corp.; 592p.; \$12. Standard reference manual brought up to date.

Natural Resources, M. R. Huberty and W. L. Flock, editors; McGraw-Hill Book Co.; 556p.; \$6.50. Survey of technological aspects of development and use of natural resources (mostly U. S.), covering air, land, water, energy, and space. Covers both animate and inanimate materials.

Nucleonics Fundamentals, by D. G. Hoisington; McGraw-Hill Book Co.; 410p.; \$9.50. Extensive survey of the applications, problems, and limitations of the use of radioactive substances in science and industry, nuclear reactors, and other nuclear devices.

Ocean of Air, The, by David I. Blumentstock; Rutgers University Press; 457p.; \$6.75. Discussion of the atmosphere and its contents, including any possible strontium-90, and the effects on man and his activities.

Petroleum Processing; Principles and Applications, by R. J. Hengstebeck; McGraw-Hill Book Co.; 348p.; \$10. Well illustrated, condensed coverage of practical petroleum refining with numerous reference sources for more detailed information.

Process Equipment Design — Vessel Design, by L. E. Brownell and E. H. Young; John Wiley & Sons; 408p.; \$19.50. Reference book and bibliographical guide to industrial practices, covering theory of proper vessel design for particular process service.

Radioisotopes for Industry, by R. S. Rochlin and W. W. Schultz; Reinhold Publishing Corp.; 190p.; \$4.75. Illustrated survey manual on benefits and uses of radioisotopes in research and development and industry, including specific examples in the fields of chemistry, electronics, mining and others.

Structural Design for Dynamic Loads, by C. H. Norris and others; McGraw-Hill Book Co.; 453p.; \$12.50. Illustrated survey of and guide to the field, including behavior of materials, analysis of dynamic response, definition of dynamic loads, and specific proportioning and dimensioning of structural members.

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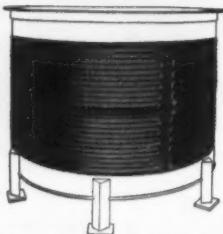
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May 4-6. Consulting Engineers Council; Board of Directors Meeting, Gearhart, Oregon.

May 5-6. American Society of Civil Engineers, Engineering Mechanics Division; Conference on Structural Mechanics, Purdue University, Lafayette, Indiana.

May 6. Ohio State University; 7th Annual Conference for Engineers and Architects, Columbus, Ohio.

May 9-12. Instrument Society of America; Summer Instrument-Automation Conference and Exhibit, San Francisco, California.

May 15-20. American Water Works Association; Annual Conference, Bal Harbour, Florida.

May 22-26. Air Pollution Control Association; Annual Meeting, Netherland-Hilton Hotel, Cincinnati, Ohio.

May 23-26. American Society of Mechanical Engineers; Design Engineering Conference, Coliseum, N. Y., N. Y.

June 1-2. Marquette University; Institute — "Recent Advances in Solid State Devices," Campus, Milwaukee, Wisconsin.

June 1-2. West Virginia University; 1960 Appalachian Underground Short Course, Morgantown, Virginia.

June 2-3. The University of Wisconsin; Engineering Institute on Consulting Engineers' Problems, Wisconsin Center Building, Campus.

June 5-10. American Society of Mechanical Engineers; Semiannual Meeting and Aviation Conference, Statler Hilton, Dallas, Texas.

June 8-11. National Society of Professional Engineers; Annual Meeting, Statler Hotel, Boston, Massachusetts.

June 13-15. American Society of Heating, Refrigerating and Air-Conditioning Engineers; Annual Meeting, Royal York Hotel, Vancouver, B.C., Canada.

June 13-17. American Society of Civil Engineers; Conference on Shear Strength of Cohesive Soils, University of Colorado, Boulder, Colorado.

June 19-22. American Institute of Chemical Engineers; General Meeting, Del Prado, Mexico City, Mexico.

June 20-22. American Society of Mechanical Engineers; Applied Mechanics Conference, Pennsylvania State University, University Park, Pa.

June 20-24. American Institute of Electrical Engineers; Summer General Meeting, Atlantic City, N. J.

June 20-24. American Society of Civil Engineers; Convention, Reno, Nevada.

June 20-25. United States Committee on Large Dams, Reno, Nevada.

July 6-8. American Society of Civil Engineers, American Society for Engineering Education; Cooper-Union, co-sponsors; Conference on Civil Engineering Education, University of Michigan, Ann Arbor, Michigan.

July 10-22. Pennsylvania State University; Seminar on Atomic Shelters (architectural and engineering planning aspects), Campus.

Aug. 17-19. American Society of Civil Engineers; Hydraulics Conference, University of Washington, Seattle, Washington.

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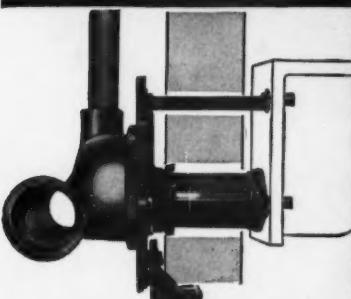
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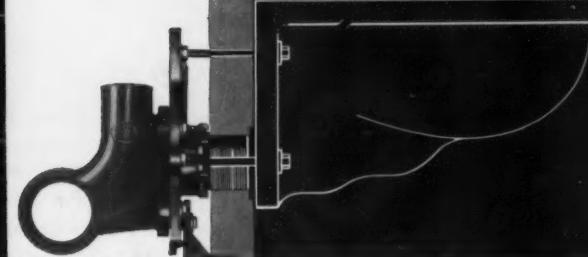
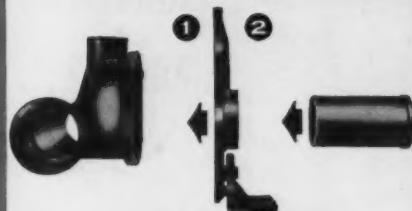
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**NEW SUTORBILT "88"
ROTARY POSITIVE BLOWERS
ARE LIGHTER . . .
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**and so versatile in performance
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from 200 to 2200 cfm up to 15 psi**



Brand New from Sutorbilt, Series "88" Rotary Positive Blowers pack oversize output in the most versatile line of light-weight, space-saving blowers available for high performance operation. Retaining such efficiencies as the 2-lobed counter-rotating impeller and the special Sutorbilt timing hub, these simple, rugged units feature:

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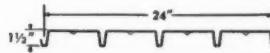
Representatives located in principal cities. Consult your classified telephone directory.



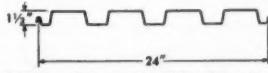
**SUTORBILT CORPORATION, 2966 EAST VICTORIA ST. • COMPTON, CALIF.
SUBSIDIARY OF FULLER COMPANY • CATASAUQUA, PA.**



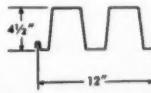
When it comes to roof systems, INLAND covers everything!



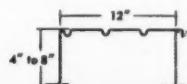
A-DECK — For purlin spacings not exceeding 8 1/4". Narrow ribs provide deck surface that supports the thinnest or softest type of insulation.



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Whether your design calls for a dry insulation board roof or for wet-fill, there's an Inland roof system for the job — by the makers of famous Milcor steel building products.

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Write for catalogs 240, 241, and 245 — or see Sweet's sections 2c/Inl, 11a/In, and 2a/In.

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Where perimeter heat is indicated, *Nesbitt Sill-line Radiation* is your prescription. The five Sill-line accessories shown here illustrate but one way this product has been designed to provide a better solution to most installation conditions. There are many others: the five enclosure styles; the six decorator colors; the one-piece back panel that permits mullion-to-mullion application on panel walls. All point up the versatility of *Nesbitt Sill-line Radiation*. For the full story, send for publication 30.



Sill-line Radiation is made and sold by
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The world's most beautiful perimeter radiation

5

Part 2 May 1960

Consulting Engineer

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AIR CLEANERS & DUST COLLECTORS



1—Purification Equipment

Bulletin 108A describes and illustrates *Dorex* activated carbon air purification equipment, C cells and H canisters. Data on equipment selection, installation, application is provided. Also given is information on unique *Dorex* replacement service. Discussions of activated carbon and conditions for proper purification.

Connor Engineering Corp.



2—Disposable Filters

Bulletin B-1300-4 describes Farr's high efficiency, completely disposable filters designed for applications requiring maximum air cleanliness. Gives description application, advantages, and components. Specifications include capacities, dimensions, and weights. Graphs show resistance characteristics.

Farr Co.



3—Gas Scrubbers

Bulletin TD-101 describes the Turbulair-Doyle gas scrubber manufactured by Western Precipitation. Ideal for separating and recovering dust, mist and fume from a wide variety of gases. May be used in combination with other types of systems. Cutaways show operation.

*Western Precipitation Division
Joy Manufacturing Co.*



4—Air Handling Products

Bulletin B-5188S offers Westinghouse Sturtevant line of air handling products and electronic air cleaners. Apparatus listed for heating and ventilating, industrial processing, cooling and dehumidifying, and electronic air cleaning. All equipment is illustrated photographically.

*Westinghouse Electric Corp.,
Sturtevant Div.*



5—Dust and Mist Collectors

Bulletin 736 illustrates the entire Aget line and includes complete dimensions and specifications. Forty basic *Dustkop* units will collect everything from wood chips to fine dust particles. Also 4 *Mist-kops*, 4 *Filterkops*, 2 *Dustbusters*. Descriptive copy and recommended uses for models. Photographs of installations.

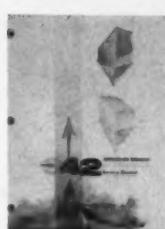
Aget Manufacturing Co.



6—Dust Control Equipment

Bulletin No. 805, describes a complete range of dry collection equipment including the multi-bag filter, uni-filter, glass bag filter, Whirl-clone, special collectors, and accessories. Illustrated application data shows how equipment is used in industry to collect dust and to reclaim reusable material. Illustrated.

Dracco Division of Fuller Co.



7—Dust Collectors

Bulletin 1828 describes American Blower Series 342 dust collectors. Typical industrial applications are listed. Sectional construction permits great flexibility of installation. Operating characteristics and construction features are included. Cutaway shows construction. Units are illustrated as well as components.

American-Standard Industrial Division.



8—Portable Dust Collectors

Small and medium size dust collectors, applicable to single machines or small groups of equipment producing undesirable dust, are described in four-page bulletin 162-6. Capacities range from 300 to 1350 cfm; 5000 fpm velocity in pipes, and 8 in. static pressure at fan.

Buell Engineering Company, Inc.

Northern Blower Division.



9—Cyclone Dust Collectors

Bulletin 10-26-50 describes Dustex cyclone dust collectors for product recovery and dust nuisance elimination where ultra-high *Miniature* efficiencies are not required. Cutaway with captions pictures operating principles. Graph shows pressure drop across collector. Dimensions of various models.

Dustex Corp.



10—Dust Collectors

Bulletin describes savings in maintenance and employee efficiency accomplished through proper control of manufacturing dust. Easily installed or moved. Adaptability of Torit Dust Collectors to typical industrial requirements is explained. Products and all types of installations are shown in photographs.

Torit Manufacturing Co.



11—Bag-Type Dust Collectors

How the *Norblo* automatic bag-type dust collector can provide continuous operation at full capacity is explained in four-page folder 184-5. Dimensions and capacities are listed in tabular form. A flow diagram explains how the unit works. Each part of the collector is shown separately with its description.

Northern Blower Co.



12—Air Filters

Bulletin B-1400-6 describes Farr's *Roll-Kleen* air filter. Comes in kit form to assemble at the point of installation. Line drawing shows construction and operation. Includes design, media, performance, installation, and maintenance. Tables show capacity in cfm and weight in lbs. Specifying instructions.

Farr Co.

AIR CLEANERS & DUST COLLECTORS *continued***13—Cyclone Dust Collectors**

Bulletin C-103 describes design and construction of Buell high-efficiency cyclones. Features include exclusive "Shave-off" port which traps extra percentage of dust, particularly smaller fines. Fully illustrated. Lists all information necessary for specifying. Covers importance of manifolding.

Buell Engineering Co., Inc.

**16—High Temperature Dust Collectors**

Bulletin F105R describes the Western Precipitation *Therm-O-Flex* high temperature dust collector for cleaning plant gases. Unlimited flexibility permits the *Therm-O-Flex* to meet the requirements of any application. Photographs and drawings show installations, operation.

*Western Precipitation Division
Joy Manufacturing Co.*

**14—Multiple Serving Dust Collector**

Dustkop model 30N50P, a one-unit system serving 7 grinders. Where floor space is limited, unit is suspended from ceiling or installed on roof. Pipe is angled from collector to caster-mounted dust drum placed in any unused area. Drum is rolled to outside dumping point and emptied without recirculating dust.

Aget Manufacturing Co.

**17—Dust Collectors**

Catalog 359 describes briefly complete line of *Torit* dust collectors for industry. Current models of both self-contained cabinet cloth filter type and cyclone separators are illustrated with dimensions and specifications for each. Installation photographs illustrate all models in use. Accessories are listed.

Torit Manufacturing Co.

**15—Dust Collectors**

Bulletin 1928 describes American-Stan-dard Series 345 dust collectors. Nomogram for selecting collector and one for determining collector efficiency are included. Cutaway shows construction. Features are outlined and typical applications listed. Various elevations show assembly arrangements. Dimensions.

American-Standard Industrial Division.

**18—Cloth-Type Dust Collectors**

Bulletin 10-27-59 describes the *Roto-Jet* cloth-type dust collector designed by *Dustex* to eliminate usual cloth filter problems. Rotating blow tube and roller support system requires no reversing mechanisms, operates with low torque, prevents cloth jamming. Drawings illustrate operating principles.

Dustex Corp.

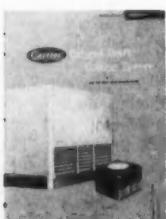
AIR CONDITIONING & REFRIGERATION**19—Residential Evaporator**

Bulletin 181 describes Model BH residential evaporator manufactured by the Bohn Aluminum and Brass Corporation. Available in five sizes of 2, 3, 4, 5, and $7\frac{1}{2}$ ton capacities. Designed for installation in horizontal runs of duct work in either new or existing systems. Diagram shows dimensions. Specifications. *Bohn Aluminum & Brass Corp.*

**21—Uni-Flo Condensed Catalog**

Uni-Flo air distribution equipment is highlighted in a new condensed catalog F-4471-6. Sidewall, ceiling and floor diffusers, high velocity equipment, and *Uni-Flo* accessories are illustrated in this new catalog. Line drawings show dimensions of units. Specifications, general and for specific models, given.

Barber-Colman Co.

**20—Induced-Draft Cooling Towers**

Catalog 22L-14 covers important design features built into large capacity, all-steel towers using lightweight, plastic-fortified pure cellulose fill. Includes complete engineering, dimensional, and loading data, along with full-operating range selection curves. Capacities range from 150 to 700 tons in a single cell.

Carrier Corp.

**22—Classroom Air Conditioners**

Bulletin 11A1 describes the *Nesbitt Year-Round Syncrizer*, specially designed for classroom applications. Available in five basic models ranging from 500 to 1500 cfm standard air, each model is offered in 12 types of vertical and horizontal chassis arrangements. Data on application and selection.

John J. Nesbitt, Inc.

To order personal copies of these bulletins fill

DIRECTORY OF ADVERTISERS' LITERATURE

AIR CONDITIONING & REFRIGERATION *continued*



23—Packaged Liquid Chillers

Bulletin RS10W describes Curtis packaged liquid chillers, 7½ through 125 tons, with either direct drive compressor, semi-hermetic compressor, or open reciprocating compressor. Basic chiller principle described and illustrated with schematic. Applications for various industries listed. Each type chiller illustrated.

Curtis Manufacturing Co.



24—Air Conditioning Units

Bulletin LL-352 describes various types of residential air heating and cooling. Water and air cooled air conditioning units, packaged and split-system air conditioning, room air conditioners, heat pumps, and gas- and oil-fired furnace are discussed in detail. All units are illustrated and specifications are given.

Chrysler Corp., Airtemp Division



25—Water Chillers

Illustrated bulletin describes the Arkla-Servel Series 3000, 25-ton, absorption-type water chillers. Gives general description and features. Includes operating details, specifications, cooling capacity, and dimensions. Four-page folder showing cycle of operation, operating costs and other data also available.

Arkla Air Conditioning Corp.



26—Absorption Chilling Systems

Catalog EM 60-2236 describes the York absorption chilling system and how it operates. Outstanding features are listed and explained. Cycle diagram in full color shows operation with each color keyed to different element in the chiller. Specifications for various models are shown in table form.

York Corp.



27—Cold Plates and Snow Pans

Bulletin 663 gives data and specifications on Dean cold plates and snow pans for food service display and preservation. Promotes food sales by keeping food absolutely sanitary at all times. No cracked ice. Easily cleaned. Shows how to do your own estimating. Beautifully printed in four colors.

Dean Products, Inc.



28—Curtain Air Conditioners

An eight-page booklet of architect sketches showing different applications of the Lennox Comfort Curtain system for heating, ventilating, and air conditioning classrooms. An attractive two-color booklet, this brochure shows heater rooms and heating equipment integrated into the design of schools and libraries.

Lennox Industries Inc.



29—Control Performance Test Report

Barber-Colman Company of Rockford, Illinois, has issued a performance test report on an electric unit ventilator controls installation in Zion, Illinois. The 14-page report tells of advantages gained through ratio room and discharge control for accurate control of room temperature. Photographs and charts.

Barber-Colman Co.



30—Air Conditioner-Dehumidifier

Bulletin 140 describes means of precise manipulation of humidity and temperature, air-conditioning critical processes of drying, and holding heat-sensitive materials, using absorbent liquid to dry air at moderate temperature without refrigeration. Diagrams, photos, chart of dehumidification, units up to 20,500 cfm. *Niagara Blower Co.*



31—Zone Control Cabinets

New 20-page bulletin AC-220 gives complete information on Type PCB Zone Control air conditioning cabinets. For use where several zones require heating, ventilating and air conditioning in varying degrees. Illustrated bulletin covers construction features, physical data, dimensions, fan performance, and coil ratings. *Buffalo Forge Co.*



32—Motorless Valve Attenuator

Bulletin K-45 describes the new Connor Kno-Draft Series 45P valve attenuator, which uses no motors or linkage of any kind, and is designed for use in dual duct high velocity air distribution systems. Features are listed, function explained and diagrammed, performance data, and dimensions. *Connor Engineering Corp.*



33—Evaporative Condensers

Bulletin 50 describes line of Marlo evaporative condensers, in three types—horizontal, vertical, low silhouette—20 sizes, capacities 3 to 250 tons. Bulletin includes photographs, drawings, construction features, performance charts, ratings, and specifications. Additional data also is included in this 24-page bulletin. *Marlo Coil Co.*



34—Central Station Air Handlers

Engineering Manual 96-386 covers all necessary technical data on Acme's complete line of vertical and horizontal central station air handlers, including specifications, dimensions, capacity data, selection procedure, line drawings. Line offers 30 models with CFM ranging from 880 to 47,500.

Acme Industries, Inc.

AIR CONDITIONING & REFRIGERATION continued

**35—Hermetic Turbopak**

Catalog EM 60-2235 describes the compact hermetic *Turbopak* used for various water chilling applications. Capacity 65 to 600 tons. Most compact hermetic centrifugal water chilling system. Cutaway shows operation and component parts. Operation is carefully explained. Diagram shows dimensions. Specifications. *York Corp.*

**41—Heating and Cooling Coils**

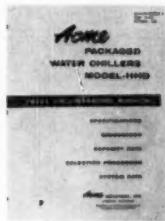
Catalog HC-1 gives complete construction specifications and dimensions on the Bohn line of direct expansion, water, and steam coils. This engineering manual is tailored to the needs of a specifying and design engineer as it provides a wide range of capacity data in easy-to-use direct selection tables. Illustrated.

Bohn Aluminum & Brass Corp.

**36—Self-Contained Air Conditioners**

Bulletin describes Governaire's self contained air conditioners with water cooled condenser. Information includes description, construction features, specifications, selection information, capacity tables, engineering data, dimensions, and wiring diagrams. Air conditioners and features are illustrated.

Governaire Corp.

**42—Packaged Water Chillers**

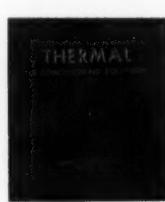
Engineering Manual 96-536 contains complete specifications, dimensions, capacity data, and selection procedure on new Acme HHD packaged water chiller line. Featured are dual hermetic compressors and two separate and distinct systems. Nine models, 40 to 250 tons. Illustrated with schematics.

Acme Industries, Inc.

**37—Water and Refrigerant Coils**

Catalog 5559 contains a full description of a complete line of water and direct expansion refrigerant coils. The catalog describes exclusive construction features with physical and performance data. Piping diagrams, architectural and engineering specifications, and many illustrations are included.

Young Radiator Co.

**43—Central Plant Air Conditioners**

Engineering catalog with illustrative and descriptive information and complete selection data on central plant conditioners, multizone conditioners, sprayed coil units, heating-ventilating units, cooling and heating coils. This catalog is notebook type and is index tabbed for easy and quick use.

Thermal Engineering Corp.

**38—Panelcoil Data Sheets**

Panelcoil data sheets series 28 through 59 give complete engineering specification tables on complete Dean line of single and double embossed *Panelcoils*. Use with bulletin 259, showing heating and cooling application data and prices. Superior *Panelcoil* takes the place of pipe coils and tubing.

Dean Products, Inc.

**44—Air Conditioners, Refrigerators**

Bulletin RS2E covers line of air conditioning units, 3 through 60 tons, and packaged liquid chillers 7½ through 125 tons. Complete specifications including cooling capacity, dimensions, and weights are given. Units are illustrated. Other products manufactured by Curtis Manufacturing Company are illustrated.

Curtis Manufacturing Co.

**39—Air Conditioning Data File**

A new high velocity data file is designed to help the air conditioning industry utilize the advantages of high velocity air transmission and distribution. It discusses what high velocity is, what it can do, and where it should be used, duct design, duct construction, and temperature control.

Barber-Colman Co.

**45—Room Air Conditioners**

Bulletin 6014 A details Dunham-Bush "CR" products for the unit system of air conditioning. Heating and cooling installations are pictured. Features, parts, model details, rating and dimensional tables, installation and piping accessories, wiring diagrams, unit selection data, capacity curves, pressure drops included. *Dunham-Bush, Inc.*

**40—Automatic Air Purifier**

Now, from the company that developed air conditioning, comes the first practical air purifier for larger commercial and industrial heating and air conditioning systems. It cleans the air without using activated charcoal, removes odors, and adds moisture to dry air. Bulletin 31BA2 describes this 4000 cfm module.

Carrier Corp.

**46—Gas Air Conditioners**

Illustrated bulletins on models of Arkla-Servel Sun Valley All-Year gas air conditioners; Model 500, 3½-ton; Model 750, 5-ton; Model 750H, High-Heat version of 5-ton unit. Explains operating cycle and gives cooling and heating specifications. Line drawings with dimensions. Combination sheets available.

Arkla Air Conditioning Corp.

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DIRECTORY OF ADVERTISERS' LITERATURE

AIR CONDITIONING & REFRIGERATION continued



47—Self-Contained Air Conditioners

Bulletin describes self contained air conditioners with evaporative condensers fabricated by Governair. Bulletin contains construction and mechanical features, unit specifications, selection information, compressor capacities, dimensions, and wiring diagrams. Units and features are illustrated.

Governair Corp.



48—Low Silhouette Condensing Units

Bulletin 7071-1 covers the "LSCU" low silhouette blower condenser with Brunnen-Metic motor-compressor, Heat-X liquid receiver, electrical controls, and refrigeration accessories mounted in specially designed section. Construction features described and illustrated. Drawings show dimensions. Specifications included.

Dunham-Bush, Inc.

COMMUNICATION & SIGNAL EQUIPMENT



49—Select-a-Guide Kit

Radio Corporation of America offers in one package Select-a-Guides on Modular Sound Systems, Microphones, Amplifier Systems, and Loudspeakers. These fold-out easy-to-use folders illustrate, describe, and give specification data on the products. This is the first time this convenient package has been offered.

Radio Corporation of America.



50—Sound Specification Manual

Engineering specification manual, 40 pages, gives complete detailed specifications on central sound systems for schools, industry, and institutions. Single, dual, and three channel systems are fully outlined with typical systems specifications covering the entire equipment for modern sound coverage.

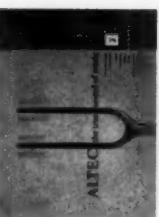
Rauland-Borg Corp.



51—Internal Telephone System

Catalog S-140 describes the benefits of a complete private internal telephone communications system. It points out profits, economy, and convenience offered by four Stromberg-Carlson switchboards with capacities from 10 to 74 lines. Four different type telephones either desk or wall are illustrated.

Stromberg-Carlson, Special Products Div.



52—Stereo and Hi-Fi Music Systems

Altec's new catalog AL 1302-1 features illustrations of custom stereophonic and monophonic installations. A special feature is the section which diagrams the proper placement of speakers and other components in a room. All components are described in detailed technical information and specifications.

Altec Lansing Corp.



53—Paging Systems

Bulletin A-2-358 describes Autocall's modern paging system designed to save time and money. Many advantages of this system are dramatically told in illustrations. How the system works is told in detail. Various types of stations are pictured and described. The wide variety of audible signals are listed.

Autocall Co.



54—Indicating and Alarm System

Bulletin 3036C describes in detail the Edison Omnidguard indicating and alarm system. A reliable, low-cost temperature detection for small or large installations. Features, operation, specifications, connections, wiring diagram, and installation procedures are given. Various types are pictured and described.

Thomas A. Edison Industries.



55—Clocks and Signals

New engineers' and architects' catalog contains general descriptions, illustrations, specifications, and complete details on time and program systems (electronic, synchronous wired, Autoset impulse); clocks (secondary, synchronous, wall, double-faced, tower, special designs); signal equipment.

Stromberg Time Corp.



56—Doctors' Register Systems

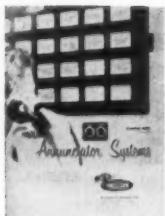
Brochure 22 describes the new Dial-In Doctors' In-and-Out Register System for large hospitals. The system permits inexpensive placement of registers at all doctors' entrances, eliminates space and wiring problems, reduces installation expense, and facilitates future expansion. For existing hospitals or new.

Auth Electric Co., Inc.

COMMUNICATION & SIGNAL EQUIPMENT continued

57—Annunciator Systems

Catalog 100C describes annunciator systems manufactured by Panalarm. The function, benefits, and selection of Panalarm annunciator systems are discussed. Included in this 50 page catalog are dimensions, plug-in relays, remote equipment and components, accessories, engineering data, and ordering information. *Panalarm, Division of Panellit, Inc.*

**58—Industrial Intercom Systems**

Bulletin 2-1293 describes Amplicall industrial intercommunication and paging systems. Paging is done through a 30 watt amplifier to penetrate high noise levels. Twelve positions for intercom conversation. Operation is completely explained and cable requirements given. Includes pictures and specifications. *Rauland-Borg Corp.*

**59—Public Address Systems**

New catalog SWC 17e/AL describes and shows examples of Altec's sound system building block flexibility. Each specialized component illustrated in the catalog is designed to work in complete harmony with every other item in the Altec line—microphones, amplifiers, pre-amplifiers, loudspeakers, and horns. *Altec Lansing Corp.*

**60—Communication Systems**

Catalog S-104R illustrates and describes 17 models, single channel to three channel communications systems. Both table top turrets and consoles with capacities from 22 to 180 rooms. Provisions included for telephone intercom, loudspeaker intercom, high fidelity FM-AM radio tuner, 3-speed transcription player. *Stromberg-Carlson, Special Products Div.*

**61—Apartment Telephone Systems**

Bulletin ACAD, loose-leaf pages, describes two-way communication systems between apartments and the vestibule or lobby; also the house manager and trades entrance, if required. Cordless loudspeaking telephones throughout prevent theft and vandalism. Types of equipment pictured, wiring diagrams, specifications. *Auth Electric Co., Inc.*

**62—Clock and Program Systems**

Bulletin CL-572 describes the centrally controlled clock and program systems for schools, institutions, public buildings, and industry. Included is description of various systems with illustrated wiring diagrams. Features and applications of various types of clocks and audible signals are discussed. Specifications given. *Edwards Co., Inc.*

**63—Modern Signal Systems**

A pocket size resume of all Edwards products for industrial and commercial applications. It fully describes the advantages and convenience of modern signaling, covering the full range from large control, communications and protection systems to single components. Various products pictured.

Edwards Co., Inc.

**64—Clock and Program Systems**

Covers clock and program systems—two types include synchronous motor-powered secondary clocks, the other combining secondary clocks, minute-impulse type. Both have simplified programming, automatic resetting of secondary clocks. Bell control boards, various type signals, and clocks included. *Standard Electric Time Co.*



To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.

65—Manual Telephone Systems

Bulletin 133A illustrates a variety of manual telephone systems from two station telephone systems to 200 line switchboard system. Quick reference for choice of system to fill the varying communication needs in the school, office, factory, home, hospital, and hotel. Specifications are included.

S. H. Couch Co., Inc.

**66—Extruded Aluminum Sheath Cable**

Catalog T-11-60 contains illustrations of General Cable's new extruded aluminum sheathed telephone cables available in 2 types. ALS for overhead use in noncorrosive atmospheres and ALSP polyethylene protected for use in all underground installations. Installation photos, weight comparison graphs, and engineering data. *General Cable Corp.*

**67—Time Recording Systems**

"First Quality for Timing Accuracy" contains general description of electronic, synchronous wired, and Autaset impulse time and program systems with illustrations of the master time control, secondary clocks, and signals. Also illustrated and described briefly are attendance time recorders, job cost recorders. *Stromberg Time Corp.*



To order personal copies of these bulletins fill

ELECTRICAL APPARATUS**68—Durasheath Rubber Power Cable**

Bulletin C-102 describes Anaconda's complete line of high voltage and low voltage rubber-insulated power cables for use in utilities, metal industry, and petroleum, chemical and processing industries, as well as residential and commercial buildings. Data on cables ranging from 600 to 15,000 volts.

Anaconda Wire & Cable Co.

**69—Aluminum Conduit Fittings**

Catalog 59 lists, in condensed form, all types of aluminum conduit fittings made by Killark Electric Mfg. Co. Contains dimensional data of such items as circuit breakers, conduit bodies, connectors, explosion-proof vapor-tight and dust-tight fittings and fixtures. Catalog numbers keyed to separate price list.

Killark Electric Mfg. Co.

**70—Power Circuit Transformers**

Bulletin P571-15 describes Jefferson's power circuit transformers, the economical, efficient approach to better power distribution. Line drawings combined with tables give all dimensional data. Application data includes selection, mounting, and conversion. Also given are wiring diagrams and specifications.

Jefferson Electric Co.

**71—Wiring Devices**

Bulletin 106-C548 is a new products bulletin which is issued periodically by the Arrow-Hart & Hegeman Electric Co. Lists and describes the latest in wiring devices. Catalog and ordering data also contained within the folder, as well as a review of current helpful literature. All new products pictured. Specifications.

Arrow-Hart & Hegeman Electric Co.

**72—Motor Controls**

This condensed catalog lists, with prices, all commonly used motor controls up to and including size 4 rating. Standard enclosures are shown. Also included are various types of starters, transfer switches, control relays, push button stations, and other controls. Catalog is illustrated, includes list of renewal parts.

Allen-Bradley Co.

**73—Anhydoprene Cables**

Bulletin 1037 describes Simplex Anhydoprene XX cables for power circuits up to 600 volts, designed for service in ducts or conduits or as open wiring in buildings. The jacket is a balanced compound of neoprene and other ingredients which provides balanced resistance to sunlight, oil, acids, heat, flame, abrasion.

Simplex Wire & Cable Co.

**74—Motor Controls**

Engineers concerned with control will find reference book 14C9462 a quick guide for starters and contactors. Capsule descriptions are provided on a complete line of ac and dc, low and high voltage, air-break and oil-immersed contactors and controllers. Includes control centers, push-buttons, and switches.

Allis-Chalmers.

**75—Diesel-Electric Power Stations**

Bulletin describes seven recently completed Deutz power stations. Installations are illustrated as well as described. Bi-colored diagrams show piping, give arrangements, and approximate dimensions. Various components below are keyed to diagrams. Proposals as to arrangement of various rooms included.

Diesel Energy Corp.

**76—Substation Aluminum Fence**

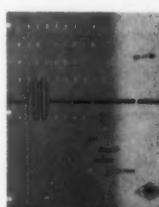
Bulletin 71-11420 describes standard substation chain link property fence of Alcoa aluminum. Each component of the fence is illustrated with a description of each item. Also included are general specifications and detail requirements. Sales offices of Alcoa are listed and complete addresses given.

Aluminum Company of America.

**77—Automatic Transfer Switches**

Bulletin 596-R1 discusses the factors to be considered in selecting automatic transfer switches to be used with your emergency power supply to assure adequate voltage power. Discussed are structural and operational features including inrush capacity, rapid transferral of load, thermal and electromagnetic effects.

Automatic Switch Co.

**78—Circuit Breakers**

"What You Should Know About Circuit Breakers for Branch Circuit Protection," 16-page manual 101, describes ways of protecting your client from fire, equipment damage, excessive wiring costs, and needless circuit interruptions. How hydraulic-magnetic circuit breakers provide this protection is pointed out.

Heinemann Electric Co.

**79—PVC Electrical Conduit**

Bulletin KFE 1058 lists physical, thermal, and electrical data for nonconducting Kraloy PVC (polyvinyl chloride) electrical conduit, with photographic installation details. Specifications for thin wall conduit ($\frac{1}{2}$ to 2 in.) and standard wall conduit ($\frac{1}{2}$ to 4 in.), all connections, couplings, and fittings are included.

Kraloy Plastic Pipe Co., Inc.

ELECTRICAL APPARATUS continued

**80—Hi-Lo Dimswitches**

Bulletin describes the Slater Hi-Lo dimswitches. This switch will replace any existing switch for incandescent lamps. Fits any standard switch box. No rewiring necessary. In low position gives 30% of light. Increases life of bulb; saves electricity. Types of plates available are shown. Wiring diagrams.

Slater Electric & Mfg. Co., Inc.

**86—Fuse-Fuseholder**

New Buss fuse-fuseholder combination for protection of individual fluorescent fixtures and other equipment on circuits of 300 volts or less. Bulletin SFH-6 tells how individual fusing reduces hazards of fires and explosions. Bulletin specifies the size fuse to use and where to locate it for the best protection.

Bussmann Mfg. Div., McGraw-Edison Co.

**81—Motor Control Centers**

Bulletin GEA-6367B describes and illustrates safety, installation, and maintenance features of General Electric's Type DA7093 motor control centers. Also gives directions for assigning short-circuit ratings and shows the various types of vertical sections available for both NEMA Classes I and II.

General Electric Co.

**87—Uni-Bus Motor Control Centers**

Bulletin 265 details construction features of a new line of motor control centers. Total safety is emphasized. Exposure to live parts is completely eliminated. Brochure contains illustrations and descriptions of components. Series of pictures show how plug-in feature works. Specifications and selection data included.

Electric Machinery Mfg. Co.

**82—Dry-Type Transformers**

This bulletin 958A describes and illustrates Sorgel Electric Company's standard line of low sound level dry-type transformers in ratings of $\frac{1}{4}$ to 3333 kva single phase and 1 to 10,000 kva three phase, 120 to 15,000 volts suitable for varied installations. Consultants will find the book valuable.

Sorgel Electric Co.

**88—Battery Charger Maintenance**

Bulletin 5845 tells how to save time in operating and maintaining automatically controlled Exide vertical motor-generator chargers used with electric industrial truck batteries. Diagrams show proper charger-battery hookup. Illustration demonstrates charger assembly and disassembly. Components pictured.

Exide Industrial Division.

**83—Drawout Metal-Clad Switchgear**

Bulletin 3-450 describes Federal Pacific's Type DST 5-350 and DST 15-1000 drawout metal-clad switchgear. Cutaway shows construction details with various important points keyed to text. Outstanding features are illustrated. Interior of metal-clad housing is shown with features keyed to text. Dimensions given.

Federal Pacific Electric Co.

**89—Magnetic Motor Controls**

Bulletin A-262 explains why Arrow-Hart's Type RA magnetic motor controls offer greatly reduced size and weight, without sacrificing performance and dependability. Open controls show construction and give dimensions. Important features and advantages outlined are illustrated with photographs and drawings.

Arrow-Hart & Hegeman Electric Co.

**84—Electrical Power Equipment**

Catalog SM-244, 16 pages, describes in detail the modern method for centralizing electrical power distribution and motor control equipment for industrial applications. It also contains suggested ideas for control specifications, and gives a simplified selector for use in control center layout and planning.

Square D Co.

**90—Electrical Systems Design Book**

Bulletin B7748 is for use by consulting engineers to prove that the best electrical system is the one which gives the greatest value per dollar of investment. Covers characteristics of good systems — flexibility, service continuity, voltage regulation, efficiency, operational cost, and maintenance. Helps in selection.

Westinghouse Electric Corp.

**85—DC Circuit Breakers**

Bulletin 4601-1A contains descriptive and technical information on the I-T-E line of Type FB DC current limiting circuit breakers. Type FB circuit breaker features are listed and illustrated. Wiring diagrams, line drawings, weights, dimensions, charts, and application suggestions are contained in the bulletin.

I-T-E Circuit Breaker Co.

**91—All-Purpose Control Cable**

Bulletin DM-5844 gives full technical data on Anaconda's thermoplastic all-purpose control cable with polyethylene insulation, double Densheath (PVC) jackets. Offers 7-wire stranding, excellent electrical characteristics, easy installation. Resists chemicals, mechanical abuse, moisture, heat deformation.

Anaconda Wire & Cable Co.

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ELECTRICAL APPARATUS continued



92—Substation Transformers

Bulletin describes the rugged and soundly built Federal Pacific transformers. Illustrated are all types of liquid filled unit substation transformers as well as the conventional pole mounted distribution transformers. Typical installations of the various transformers are shown in pictures. Complete technical data.

Federal Pacific Electric Co.



93—Integral Distribution Centers

Bulletin GEA-6928 describes GE's dry-type integral distribution centers featuring QHT transformers for applications up to 5000-volts. Installation instructions, features, dimensions and cable space, selection data, ratings, and panelboard components are included. Material specification form helps you specify.

General Electric Co.



94—Electrical Plants

Catalog KEP56-1, 24 pages, shows the line of Kohler electric plants used as an independent source of electricity for sole supply and for automatic standby when central station power fails. Sizes range from 500 w to 100 kw, gasoline and diesel. Battery charging units in 6, 12, 36, and 140 v capacity are described.

Kohler Co.



95—Compact Unit Substations

Bulletin 5604-1A describes *Transfo-Units* for indoor or outdoor, ratings 45 through 2500 kva, primary through 14.4 kv, secondary through 600 volts. These units, completely pre-engineered load centers for stepping down primary voltages, contain transformer and its primary and secondary distribution devices.

I-T-E Circuit Breaker Co.



96—Dry-Type Transformers

Bulletin S-202-C describes a completely redesigned line of dry-type transformers as offered by the Standard Transformer Co. for light, power, and control. They are built to NEMA and ASA specifications. Lower sound levels, better cooling, improved regulation, and reduced size and weight are shown in bulletin.

Standard Transformer Co.



97—AC Polyphase Motor

Bulletin GEA-6865 describes new custom "8000" ac motor, 150 hp and larger. The added value features of the line are described. Illustrated with cutaway drawings and exploded-view photographs. Available for exacting applications found in rubber, paper, utility, petroleum, chemical, and rock products industries.

General Electric Co.



98—Squirrel-Cage Motors

Bulletin MU-244 describes doubly-protected and totally-enclosed polyphase squirrel-cage motors, 1 hp and larger with NEMA "C" faceplates for close-coupled pump applications. Illustrates the particular electrical and mechanical features that make them prime partners for close-coupled centrifugal pumps.

Wagner Electric Corp.



99—Aluminum Plug-In Duct

Bulletin SD-110 describes Square D aluminum plug-in duct with I-beam construction of bus bars. The 6-page, 2-color bulletin explains use of plug-in duct, tells why aluminum is used as a conductor. Includes convenient voltage drop curves, suggested specifications, and list of available accessories.

Square D Co.



100—Dry-Type Transformers

Bulletin 46-950 contains complete statistical information on single and three-phase dry type transformers. For each type transformer there are dimension and layout drawings, limit capacities, such engineering application data as decibel readings, space and weight saving features, case temperatures.

Westinghouse Electric Corp.



101—Panelboard Circuit Breakers

Bulletin 3103 covers the Heinemann series 0911, an economical panelboard circuit breaker dimensionally interchangeable with other makes. Available in 1- and 2-pole models, 0.050 to 60 amperes, the 0911 uses hydraulic-magnetic actuation to end heat-induced nuisance tripping. Fast short-circuit interruption.

Heinemann Electric Co.



102—Fibre Conduit

Catalog 52 describes Orangeburg's standard and Nocrete conduit for installation with and without concrete encasement. Manufacturing methods, advantages, and properties given. Method of joining and tooling pictured and explained. Fittings of various kinds are diagrammed and dimensions given.

Orangeburg Manufacturing Co., Inc.



103—Shallow Depth Switchboards

Bulletin 2015 describes shallow depth switchboards, a complete line of distribution switchboards through 2000 amps. Shows how you can add your choice of distribution sections or combined metering and distribution in a single section. Completely illustrated. Specifications included. Layout with dimensions.

Federal Pacific Electric Co.

ELECTRICAL APPARATUS continued

104—Low Voltage Circuit Breakers

Bulletin 4261-2B describes I-T-E's new *U-Re-Lites*, individually enclosed low voltage power circuit breakers. Information includes design, safety features, enclosure dimensions, selection chart, application data, and coil ratings. All features are illustrated photographically, as well as installation procedures.

I-T-E Circuit Breaker Co.

**105—Terminating, Splicing Fittings**

"O.Z. Terminating and Splicing Fittings for Interlocked Armor Cable," 36-page engineering bulletin 135A, gives complete specifications, dimensions, cutaway drawings, photographs, and installation instructions. Prices and weights also are given for each item, along with ordering data and available materials.

O. Z. Electrical Mfg. Co.

**106—Open Dry-Type Transformers**

Bulletin GEA-6668A fully describes General Electric's low-sound open dry-type transformers for industrial and commercial applications. Units are rated 300 kva and above, 601 to 15,000 volts. Advanced construction features are illustrated and electrical and mechanical characteristics charted. Installation data.

General Electric Co.

**107—Emergency Power Guide**

Booklet 40-20205-DN927 is Caterpillar's guide book for emergency power. Describes in detail the three sources of standby power — central battery systems, two circuit systems, and emergency generator sets. Details many advantages of diesel generator sets. Selection of proper diesel.

Caterpillar Tractor Co., Engine Division.

**108—Controlway Systems**

Bulletin describes Cope *Controlway*, a low cost method of supporting low voltage control cables, signal cables, and instrument tubing. Advantages of *Controlway* are listed. *Controlway* is illustrated as are other Cope cable supporting systems. Complete line of system fittings meet exacting requirements.

T. J. Cope Div. of Rome Cable Corp.

**109—Assembled Switchgear**

Bulletin 32-250 outlines indoor and outdoor assembled switchgear utilizing type DH De-ion drawout air circuit breakers. Contains switchgear engineering design features, outline dimension drawings, application data, and specifications. For commercial buildings, industrial plants, electric utilities and public works.

Westinghouse Electric Corp.

**110—Pole-Type Capacitors**

Bulletin 8145 and 8148 describe individual pole-type capacitors and capacitor assemblies. Cutaway shows construction and components of individual capacitor. Ratings and dimensions on both low and high voltage types. Line drawings with dimensions illustrate mounting brackets from single unit to six unit size.

Federal Pacific Electric Co.

**111—Power Centers**

Bulletin 47-350 contains descriptive information and operating data regarding the new Westinghouse self-contained dry or liquid type power centers. Illustrations and technical information on application and rating capacities. Dry type transformers are ventilated or sealed and liquid units are oil or *inerteen*-immersed.

Westinghouse Electric Corp.

**112—Dimmerboard Systems**

This 24-page bulletin explains basic components of stage dimmerboard systems, as well as optional components and features. Complete description of standardized dimmerboards, plus convenient selection chart. Specifications for all types of dimmerboard systems and layout dimensions are included.

Square D Co.

**113—Synchronous Motors, Generators**

Bulletin SB-154 describes Marathon Electric's synchronous high speed motors and generators. Typical construction features are listed and illustrated. Components shown. Application of Marathon synchronous generator matched to diesel engine with generator-mounted controls for minimum space requirements pictured.

Marathon Electric Mfg. Corp.

**114—Master Laytex Portable Cord**

Booklet KW-896 describes remarkable portable cord. Tests show Kaiser Master Laytex superiority in combating eight causes of cord failure and how it does the job of 3 conventional mold-cured cords. Book describes tests, charted results, and lists applicable specifications. Cutaways and photographs.

Kaiser Aluminum & Chemical Sales, Inc.

**115—Molded Case Circuit Breakers**

Compact pocket-size bulletin 5004-1A gives construction and performance features, ratings, and details on complete line of I-T-E molded case breakers by types, current ratings, overcurrent devices, accessories, and modifications available. Each model is illustrated in column over specifications.

I-T-E Circuit Breaker Co.



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DIRECTORY OF ADVERTISERS' LITERATURE

ELECTRICAL APPARATUS continued



116—Mineral Insulated Cable

Brochure S-2-60 deals with an unusual self-contained wiring system known as MI. The brochure outlines method of fabrication and suggests installation procedure. Also included is information covering MI for hazardous area and instrumentation applications along with photos of actual installations.

General Cable Corp.



117—Medium Transformers

Bulletin GEA-6984 describes the full line of transformers available from the Medium Transformer Department of the General Electric Co. Included are construction features, ratings, and application data. Various transformers are illustrated and installation procedures are pictured. GE features complete service.

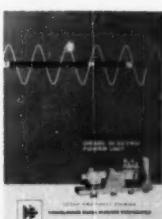
General Electric Co.



118—"Rocker-Glo" Switches

Illustrated four-page brochure describes new Rocker-Glo switch by Pass and Seymour. It has a luminous button and operates silently. Available in 15 or 20 amp, 120/277 volts ac. It has easy-to-wire pressure or screw terminals. Comes in Despard type with strap or Despard interchangeable.

Pass & Seymour, Inc.



119—Standby Diesel Power Supply

Bulletin UPS 1059 details Consolidated's standby power units for uninterrupted power supply in case of normal power failure. Includes applications, outstanding features, and construction. Schematics show operation and photo-oscillographs show performance. Page of complete specifications also included.

Consolidated Diesel Electric Corp.



120—Electric Wiring Devices

Catalog 2-57 describes various wiring devices manufactured by the Slater Electric & Mfg. Co. Includes appliance switches, lampholders, power outlets, receptacles, switches, weatherproof devices, wall plates, and automatic Klok-A-Lite. Loose leaf catalog consisting of numerous illustrated Slater bulletins.

Slater Electric & Mfg. Co., Inc.



121—Underfloor Duct System

Catalog 203 describes the Orangeburg underfloor duct system, non-metallic underfloor raceways for distribution of electrical wiring in commercial, industrial, and institutional buildings. Drawing keyed to index shows components, which are also pictured and described. Instructions for installation given.

Orangeburg Manufacturing Co., Inc.



122—Metalclad Switchgear

New brochure describes components, applications, and performance of metalclad switchgear, ratings to 500 MVA short circuit interrupting and 44,500 amp fault closing. Drawings show substation, switching center, and service entrance applications. Typical installations and construction shown.

S & C Electric Co.



123—Rotary Handle Circuit Breakers

Bulletin 1425 describes Federal's rotary handle circuit breakers for switchboards, control centers, panelboards, and individual enclosures. A complete line, 15 through 800 amps. Advantages listed and illustrated. Cutaway shows construction as well as component parts. Shows space saved over conventional types.

Federal Pacific Electric Co.



124—Control Centers

Control Centers in three construction types, NEMA Type "A", "B", and "C" are explained in bulletin B-6722. Information charts on short circuit protection, control center arrangements, selection of starter sizes and starter components, application and engineering data, dimension and circuit diagrams.

Westinghouse Electric Corp.



125—Unit Substation Transformers

Bulletin 5804-1A gives information on I-T-E unit substation transformers in ratings from 112.5 to 3000 kva. Focuses attention on construction details of the transformer line which includes oil or askarel immersed and ventilated dry type units. Provides data on I-T-E primary devices for use with unit substations.

I-T-E Circuit Breaker Co.



126—Automatic Transfer Switches

Bulletin IR-0033 on Zenith transfer switches in emergency power systems. Describes switches mechanically held in normal and emergency positions, mechanically held in one position and electrically held in other, magnetically or electrically held in both. Also details and diagrams on designing systems.

Zenith Electric Co.



127—Transformer Buyer's Guide

Bulletin 1047, Buyer's Guide to help in specifying and ordering dry-type transformers. A quick and easy-to-use single source of specifying and ordering information. Pictorial index gives basic descriptions, application information, and page numbers on which prices, dimensions, and other data are found.

General Electric Co.

ELECTRICAL APPARATUS continued

**128—Single, Multi-Speed Starters**

Describes single and multi-speed starters, including combination and reversing starters, plus Square D Spin Top enclosures for hazardous locations. Also describes motor control racks for field mounting of Spin Top enclosures and other equipment. Bulletin includes price and dimension information.

Square D Co.

**134—Distribution Transformers**

Bulletin S-401-C describes the Standard Transformer Company's line of distribution transformers with lower losses than ever before offered in the transformer industry. Includes charted performance data. Suggests formula for calculating annual operating costs. Features described and cutaway shows components. *Standard Transformer Co.*

**129—Molded Case Circuit Breakers**

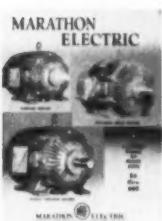
Bulletin GEA-6754 describes the General Electric line of molded case circuit breakers, 15 to 800 amperes, plus matching enclosures in flush, surface, raintype enclosures. Includes simplified guide to determine ampere rating of breakers for specific applications. Cutaway shows component parts.

General Electric Co.

**135—Electrical Wiring Devices**

Catalog 60, 75 illustrated pages, describes complete range of electrical wiring devices. Both the interchangeable Despard line and the P&S conventional line. Everything from switches to fixtures to devices for every purpose are listed. A 15-page index and price list are also included in this catalog.

Pass & Seymour, Inc.

**130—Totally-Enclosed Motors**

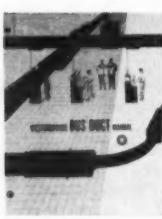
Bulletin SB-185 describes Marathon chemical, and explosion-proof, totally enclosed electric motors. A wide range of sizes and designs with frames 56 through 680. Cutaway shows internal ventilating scheme. Components are shown and keyed to descriptions. Installation photographs of both types are included.

Marathon Electric Mfg. Corp.

**136—Ultra-Quiet Motors**

Bulletin MU-245 lists motors 1/6 through 10 hp, available with resilient mountings. Literature thoroughly covers resilient motor mounting construction and applications, along with larger ratings that were developed to meet the demands of makers of central air conditioning units who require ultra-quiet operation.

Wagner Electric Corp.

**131—Bus Duct Layout**

Booklet B-4272-D is designed for consultants' use in planning and selection of units for bus duct layout in commercial, institutional, and industrial buildings. Plugin duct, outdoor feeder duct, low-impedance duct, and *Life-line Busway* are fully covered. Completely illustrated with engineering and test data.

Westinghouse Electric Corp.

**137—Secondary Unit Substations**

Bulletin 3104-1A supplies detailed information on secondary unit substations, complete and compact load distribution centers for indoor or outdoor application. Gives data and specifications on a large variety of primary devices, transformers, and secondary switchgear offered in I-T-E secondary unit substations. *I-T-E Circuit Breaker Co.*

**132—Synchronous Low-Speed Motors**

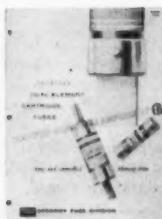
Bulletin 174 describes a line of engine type, synchronous motors for direct connection to compressors and other low-speed drives. The motors are built to form C Construction, 450 rpm and lower. Protective enclosures are available. Mechanical construction features are emphasized. Components are illustrated.

Electric Machinery Mfg. Co.

**138—Cable Supporting Systems**

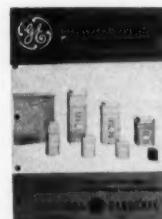
Catalog 1257 describes Cope cable supporting systems — cable trough, cable ladder, channel support systems, and accessories. Each type of cable support is explained and illustrated. Product identification line drawing keyed to index makes this loose-leaf catalog easy to use. Parts are illustrated. Available sizes.

T. J. Cope Div. of Rome Cable Corp.

**133—Dual-Element Cartridge Fuses**

Bulletin 1330 describes Econ dual-element cartridge fuses in designs to meet various circuit conditions. Cutaways show construction and components of ferrule type and knife blade type fuses. Line drawings show operation. Tables and charts complete technical data. Test report certified by ETL included.

Federal Pacific Electric Co.

**139—Stabilizing Transformers**

Bulletin GEA-5754D gives a quick, easy-to-use source of specifying and ordering information on the General Electric voltage stabilizing transformer. This illustrated bulletin tells why voltage varies, how voltage stabilizing transformers work advantages, operating characteristics, and where they are used.

General Electric Co.

To order personal copies of these bulletins fill

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ELECTRICAL APPARATUS continued

140—Heavy Duty Safety Switches



New advances in safety switch design are described in Bulletin CPD-74, a 32-page illustrated booklet, which describes General Electric's new line of 30-600 ampere light and heavy duty safety switches. Featuring visible blades and quick-make, quick-break contacts, the switches are space savers.

General Electric Co.

146—Rigid Aluminum Conduit



Bulletin EC-885 describes Kaiser's rigid aluminum conduit. It is light weight, corrosion resistant, nonmagnetic, non-sparking, and easy to install. Standard installation procedures, dimensions, weights, and packaging details are given. Industrial applications are listed. Illustrated with photographs and diagrams.

Kaiser Aluminum & Chemical Sales, Inc.

141—Electrical Equipment Manual



New 20-page manual gives comprehensive specification data on Square D electrical equipment — safety switches, panelboards, switchboards, dimmerboards, control centers, bus duct, and substations. The manual also includes convenient reference guide to National Electric Code requirements.

Square D Co.

147—Protective Fuses



Bulletin HCS tells how Buss Hi-Cap fuses have unlimited interrupting capacity on any voltage up to 600 to provide safe protection for loads above 600 and up to 5000 amperes. Describes operating characteristics and advantages, illustrates dimensions, contains charts on current limiting effect and opening times.

Bussmann Mfg. Div., McGraw-Edison Co.

142—Standby Diesel Power Units



Bulletin P-1 describes Consolidated's diesel powered generating units which furnish uninterrupted electric power supply in case of normal power failure. Various types of units are detailed with illustrations, operating features, diagrams showing operation. Specifications and approximate dimensions are included.

Consolidated Diesel Electric Corp.

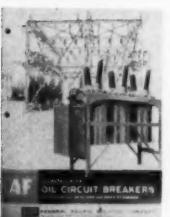
148—Enclosed Circuit Breakers



Bulletin 5004-F gives information on individually enclosed molded case circuit breakers for overcurrent protection of all vital circuits. Provides ratings and features and includes illustrations of I-T-E molded case and Cordon current-limiting breakers for varied applications. Cutaway shows operation.

I-T-E Circuit Breaker Co.

143—Oil Circuit Breakers



Bulletin 7213 describes Federal Pacific's AF frame-mounted oil circuit breakers. Line drawing shows construction of single pole units. Component parts as contact mechanism, interrupters, mechanical linkage, operating mechanism, construction, bushings, and transformers are completely illustrated and explained.

Federal Pacific Electric Co.

149—Stationary Batteries



Bulletin 4676 describes how best to install and operate Exide antimony alloy stationary batteries. Applies to recent EWA and FWA lines as well as to Exide-Manchex and Exide-Tytex types. Includes instructions for charging methods and operating rules.

*Exide Industrial Division
Electric Storage Battery Co.*

144—Transformers and Substations



Bulletin 655 describes Sorgel's load center transformers and substations in capacities up to 3000 kva and voltages up to 15,000 volts. Includes information on application, sizes, types, and construction. Advantages are listed and all units are illustrated. Old way of power distribution is compared to new way.

Sorgel Electric Co.

150—Electrical Fittings



Loose-leaf catalog 135 has been prepared to provide all the technical information you need to select the right conduit fittings, cable terminators, cast iron boxes, and solderless connectors for each of your electrical installations. It includes a comprehensive index and a section of useful engineering data.

O. Z. Electrical Mfg. Co.

145—Aluminum Plug-In Busway



Bulletin GEA-6173 completely describes the new General Electric Type DE aluminum plug-in *Flex-A-Power* busway. Describes unique one-belt joint, tubular aluminum conductors, and butyl insulated bus bars. Available in 3- or 4-wire systems for applications up to 600 volts, ac or dc. Specifications and installation data.

General Electric Co.

151—Switchboard Layout



This 72-page bulletin gives complete layout and specification information on Square D 14-in. switchboards. Separate sections on circuit breakers and fusible equipment for service and distribution systems. Contains detailed layout and dimension drawings, wire and conduit tables, and lists NEC requirements.

Square D Co.

ELECTRICAL APPARATUS continued

**152—Electrical Motors**

New Westinghouse Life Line "A" motors set standards of motor performance for greater application flexibility. Stronger insulating materials, best electrical performance, improved accelerating torque, pre-lubricated bearings, dynamic balancing of moving parts, armorized frame and other features are explained.

Westinghouse Electric Corp.

**153—Metal-Clad Switchgear**

Bulletin 2804-1A describes I-T-E 4160 volt metal-clad switchgear. Circuit breakers of equal rating are completely interchangeable from frame to frame. Pictures show safety features, accessibility to component parts for inspection and maintenance. The complete story of both indoor and outdoor switchgear told.

I-T-E Circuit Breaker Co.

**154—Integral Cable**

Bulletin 1038 describes Simplex C-L-X, the lightweight, corrugated, impervious metallic cable sheath available in three new metals. Previously made of steel, C-L-X cable systems may now be ordered with copper, aluminum, or bronze flexible coverings. Advantages of the new metals are enumerated.

Simplex Wire & Cable Co.

**155—Protective Relays**

Bulletin 6200 describes Federal Pacific protective relays, designed to reduce maintenance, adjustment, and testing time. Open relay shows construction and components which are keyed to detailed explanation below. Each type of relay is illustrated and described. Complete specifications are given in table form.

Federal Pacific Electric Co.

ENGINEERS' OFFICE & FIELD EQUIPMENT**156—Electronic Computer**

Complete specifications on the new RPC-4000 electronic computing system are given in brochure S-483. The RPC-4000 is a fully transistorized, electronic stored program, general purpose computing system, for both engineering and business data processing. System is modular and offers complete flexibility.

Royal McBee Corp.

**157—Dictating-Transcribing Machine**

Bulletin AD-577 describes DeJure-Amsco's versatile dictating-transcribing machine. This compact, economical, fully transistorized Stenorette-T is engineered for dependable service. Full color folder shows unit with features detailed and illustrated. Included is the Stenorette companion, a portable counterpart.

DeJure-Amsco Corp.

**158—Copyflex Print Makers**

Catalog A-2360 explains the basic principles of the Bruning Copyflex diazoype process, and how to make fast, economical whiteprints with a wide choice of machines and materials. Complete details on engineering applications and types of reproductions for high quality prints at minimum cost. Fully illustrated.

Charles Bruning Co., Inc.

**159—Portable Microfilmer**

Bulletin A-948 describes the new Recordak portable microfilmer. Illustrated in full color, this six page folder explains and illustrates the outstanding features. This portable microfilmer weighs less than an office typewriter, 24 lbs, and measures 6½" x 15½" x 12½". Fits compactly into a handy carrying case.

Recordak Corp.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.

160—Microfilming Systems

A presentation of modern microfilming in booklet form by Recordak, the originator of modern microfilming. Explains the system in precise form. Shows sample films of the various steps in recording a specific engineering drawing. Finally reproductions of the film printed on opaque and translucent vellum stock.

Recordak Corp.

To order personal copies of these bulletins fill

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ENGINEERS' OFFICE & FIELD EQUIPMENT continued



161—Steno-Sheet Dictating Machine

Bulletin AD-504 describes DeJure-Amsco's magnetic *Steno-Sheet* recording medium. The most advanced dictating-transcribing system ever created. Dictation is recorded on a erasable, reusable, magnetic sheet of indestructible polyester film. *Steno-Sheet* can be clipped to collateral correspondence.

DeJure-Amsco Corp.



163—Planetary Microfilm Camera

Bulletin A-2557 available from the Brunning Co. describing the *Dea-Graph* Model CA7 35 mm planetary camera. Complete specifications for camera, and Model EA1 35 mm enlarger head which converts unit into a microfilm enlarger. Designed for making precision microfilm reproductions of engineering drawings.

Charles Brunning Co., Inc.



162—Data Processing System

Booklet 520 introduces the desk-sized IBM 1620, designed primarily to process research and engineering problems. Speed and capabilities are listed together with the advantages to be derived from this advanced storage and computing system. Programming systems available for use with the 1620 are shown.

International Business Machines Corp.



164—Electronic Digital Computer

Brochure S-526R1 describes the Royal Precision LCP-30, a desk-sized, stored-program, general purpose electronic digital computer. Specifications and features are listed and illustrated. New optional photo-electric punched tape reader and high-speed punch unit illustrated. Components described and pictured.

Royal McBee Corp.

FIRE PROTECTION EQUIPMENT



165—Interior Fire Equipment

Catalog covers all types of fire protection equipment with technical data and art: sprinkler, CO₂, dry chemical, and foam systems; smoke detecting and alarm systems; hose racks and cabinets; hose, nozzles, and fittings; various types of portable extinguishers. Nine famous brands, 1200 products, from one source.

Fyr-Fyter Co.



166—Fire Alarm Systems

Bulletin 131A explains, "What is a Couch local fire alarm system?" It tells how to select, from a complete line of systems, the modular fire alarm system for your institutional, commercial, or industrial building. Each of your system layouts include wiring diagrams, specifications, and a variety of optional features.

S. H. Couch Co., Inc.



167—Fire Alarm Systems

Catalog illustrates and describes Standard's March Time, Master Code, and Box Code systems. Also covered are supplemental pre-signal circuits, non-code continuous sounding bells and horns, code transmitters, control panels, stations, detectors, signals, and accessories. Specifications included.

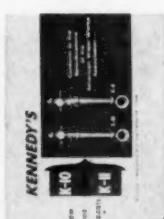
Standard Electric Time Co.



168—Fire Hydrants

An AWWA compression type, dry head fire hydrant with swivel flange below nozzles permitting nozzle section to be rotated 360° without removing bolts. Outer protection case permits removal of complete barrel for replacement or repairs without excavating. Bell, mechanical joint or flange pipe connections.

R. D. Wood Co.



169—Fire Hydrants

Bulletin 591 provides details on new Kennedy K-10 and K-11 safety breakable section hydrants. Both meet AWWA specifications. Includes cross section views with complete parts description and numbering system, installation and maintenance suggestions. List of particulars for estimates and orders.

Kennedy Valve Mfg. Co.



170—School Fire Alarm Systems

Bulletin A-3-1158 describes Autocall's Type SA fire alarm system for better school protection. Combines many safety features to insure continuous, self-supervised operation, and flexibility to incorporate fire detection devices. Open control panel shown construction. Schematic wiring diagram. List of representatives.

Autocall Co.

HEAT EXCHANGERS & WATER HEATERS**171—Steam and Water Service Manual**

Engineers designing steam and water service systems can use this manual as a reference guide. Piping diagrams and control equipment descriptions are given for self operating and pneumatic control of fuel oil and storage heaters, domestic hot water, process and two-temperature hot water, and heat exchangers.

Powers Regulator Co.

**172—Heating Radiation Water**

Complete information on heat exchangers for heating radiation water with steam is supplied in this 32-page catalog. Rating tables are supplied for 67 different units with 10, 20, 30 and 40 degree temperatures and steam pressures ranging from 2 to 25 pounds. Catalog SC-159 also includes material specifications.

Bell & Gossett Co.

HEATING & VENTILATING EQUIPMENT**173—Convector Radiators**

Catalog 4059 illustrates and fully describes how modern design and engineered heating efficiency combine to make Young convector radiators ideal for steam or hot water heating systems. Technical data, general application photos, construction features, steam and hot water capacities, dimensional data.

Young Radiator Co.

**177—Controlled Ventilation**

Catalog G-59-A describes controlled ventilation assuring the right ventilator for every job. This catalog provides a carefully developed guide to help consulting engineers determine exact ventilation equipment best suited for specific needs. Includes dimension, performance, and capacity charts. Illustrated.

Loren Cook Co.

**174—Translucent Gravity Ventilators**

Bulletin LX-59, a supplement sheet to bulletin LX-59C, provides detailed information for low silhouette gravity exhausters with translucent fibreglass dampers and weather caps. Light values of illuminations are presented in table form. Drawings, units, dimensions, gauges, and weights are included.

Penn Ventilator Co., Inc.

**178—Applying Industrial Heaters**

Bulletin IND-591 supplies all needed data to design industrial heating jobs using direct-fired heaters (with heat exchangers). It has definitions, heat loss calculations, nozzle and duct air distribution, single and multiple installations, door heating, process heating, make-up air, controls, fuel piping, and usage.

Lennox Industries Inc.

**175—Aircoustat Sound Traps**

Catalog 464-M76 describes Kopper's complete line of Aircoustat sound traps for use in air handling systems. Drawings show system with individual details of components. Three steps in proper selection are given in detail. Airflow tables for single and multiple units included. Suggested installation methods.

Koppers Co., Inc.

**179—Steam Coils**

Bulletin M-10 contains information on new Marlo Eventemp distributing steam coils, for modern heating systems using modulating or two-position controls. Unique design provides even temperature throughout entire face area, even when partially throttled during light loads, with precise control.

Marlo Coil Co.

**176—Classroom Unit Ventilator**

The new Nesbitt Series 600 Syncretizer is described in Bulletin 10A1. This catalog presents complete engineering data for the selection and application of this product. Complete details and specifications for new line of storage facilities for integration with the new Series 600 Syncretizer also included. Illustrated.

John J. Nesbitt, Inc.

**180—Industrial Fire Ventilators**

Scientific paper dealing with disastrous spreading of industrial fires when no openings are provided for escape of super-heated air and smoke, and the solution: Colt dual purpose fire ventilators which drop open in case of fire and act as an efficient natural ventilating system in normal plant operation.

Colt Ventilation of America, Inc.

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HEATING & VENTILATING EQUIPMENT continued



181—Roof Exhaustors

Bulletin 100-1959 describes Ammerman's PB and BCD AirXpeler power roof exhaustors fabricated of aluminum or molded reinforced fibreglass. Offered in a large variety of sizes and speeds. Gravity or fresh air intakes available. Catalog illustrated with photographs and diagrams. Complete specifications.

Ammerman Co., Inc.



186—Radiant Panel Heating

"Radiant Panel Heating with Steel Pipe," 48 pages, covers the history of this type of heating, basic design, floor, ceiling, and wall panels, information on snow melting systems, pipe coil integration, design of a floor coil system, and a boiler hook-up diagram.

*Committee on Steel Pipe Research,
American Iron and Steel Institute.*



182—Counterflow Space Heaters

Bulletin 580-12 describes Dravo's industrial counterflow space heater. Designed for comfort heating, ventilating, process drying, wake-up air, and heat curing. Upright, inverted, and horizontal models diagrammed. Included are dimensions, engineering data, and specifications. Cut-away shows construction.

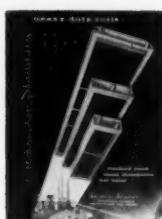
Dravo Corp.



187—Multi-Zone Platecoil

Bulletin 159, 48 pages, completely describes new Multi-Zone Platecoil, covering styles, dimensions, specifications, and operational data. Methods of calculating heat transfer equipment requirements are outlined. Typical installations are pictured and described. Available on request.

Tranter Manufacturing Inc.



183—Heavy Duty Heating Coils

Bulletin B-1518 presents the first complete line of heavy duty heating coils designed and built to meet the rigors of industrial service. Advantages, materials, and construction outlined. Each type of coil is illustrated and specifications are shown in chart and diagram. Selection data in charts, graphs, and diagrams.

American-Standard Industrial Division.



188—Condensed Ventilator Data Book

Burt's complete line of power and gravity ventilators and wall louvers are described and illustrated in concise form in engineering bulletin SPV-101I. Important technical data, design, construction, capacities, performance, and dimensions are provided for each type. Cut-aways show operation.

Burt Manufacturing Co.



189—Airfoil Blade Fans

Catalog 859 describes a new line of highly efficient, quiet airfoil blade fans. Dynafoil fans are particularly applicable to mechanical draft and heavy duty applications, such as industrial processes, conduit air conditioning, and tunnel ventilation. Various arrangements and panel openings pictured. Dimensions given.

Clarage Fan Co.



184—Scotch-Type Packaged Boilers

Modern scotch-type 3-pass design gives these boilers certified efficiencies of over 80%. Flue gas temperatures in the 400° to 450° range, 20 to 800 hp, and new SBI 5 sq ft per hp fireside heating surface ratings. Designed for oil, gas or oil/gas firing. Shipped in single units or boiler-burner packages.

Burnham Corp., Steel Boiler Department



190—Tubeaxial Fans

Bulletin 620 illustrates and describes Type BT and BTV belt driven tubeaxial fans for handling corrosive fumes, high temperatures, explosive fumes, abrasive dusts, dirt laden air, and high humidity. Drawings are shown for totally enclosed, corrosion resistant, and ventilated assemblies. Ratings and sizes chart.

Robbins & Myers, Inc., Propellair Div.



185—Heavy Duty IPL Fans

Heavy duty industrial IPL fans that range in capacity from 4000 cfm through 154,000 cfm with static pressures to 12" wg are described in Bulletin 572. Sturdy all-welded construction and easy maintenance features make these fans ideally suited to severe industrial air moving applications. Illustrated.

New York Blower Co.



191—Recirculation Generators

Basic advantages of the Type LFW forced recirculation generators for high temperature water are given in ten-page bulletin 700. Chart compares capital investment, operating costs, and maintenance and repairs for high temperature water and high pressure steam for district heating from central plant.

International Boiler Works Co.

HEATING & VENTILATING EQUIPMENT continued

**192—Platecoil**

This bulletin, 59-PI, describes and illustrates the new Platecoil configuration. It contains pertinent information on construction, application, and advantages in heat transfer. Specifications, size, weight, and surface area of standard units are listed. Varied applications are pictured and discussed.

Tranter Manufacturing Inc.

**198—Gravity Ventilators**

This bulletin describes the two unique features of the Colt S.R. Series of low silhouette natural gravity ventilators: (1) Hinged top flaps open for normal extraction, full for optimum extraction in hot weather, seal heat in when fully closed. (2) New aero-foil curve design produces maximum positive extraction.

Colt Ventilation of America, Inc.

**193—Power Roof Ventilators**

Bulletin 680-C describes Sky-Blast power roof ventilators. Weatherproof features include corrosion-proof, aluminum alloy propeller; nonclogging dampers and rain-shed; one-piece all welded base hot-dip galvanized after fabrication. Automatic fire-vent release. Sizes to 60 inches; air deliveries to 78,000 cfm.

Robbins & Myers, Inc.

**199—Gravity Roof Ventilators**

Bulletin AEG-60 gives engineering data for quick, easy selection of square and rectangular size gravity roof ventilators. Extensive charts from 500 to 40,000 cfm and static pressure losses for discharge or relief units are explained and diagrammed. Intake velocities from 1500 to 35,000 cfm included. Detail drawings.

Penn Ventilator Co., Inc.

**194—Industrial Space Heaters**

Twelve-page bulletin describes OG-581 new design space heater. Gas, oil, or combination dual fuel burners with push-button changeover. Output from 280,000 Btu/h up. Rugged construction with completely enclosed burner adaptable for space heating, ventilation, make-up air, process heating, air conditioning.

Lennox Industries Inc.

**200—Air Diffusers**

Bulletin K27-A illustrates and describes linear and rectangular series air diffusers. Offered in three series—square, panel, long-slotted—units combine best air distribution and modern styling. Dimensional drawings for several types in each series provided. Complete selection and performance data, list of agents.

Connor Engineering Corp.

**195—Compact-Type Steel Boilers**

Catalog SB107 gives new SBI ratings and engineering details on the Burnham Compact-Type steel boiler. Designed to compress maximum heating capacity into minimum floor space. It is available for oil, gas, and coal firing. Capacities from 2,930 to 39,370 sq ft SBI net steam EDR new ratings.

Burnham Corp., Steel Boiler Department.

**201—Aluminum Centrifugal Ventilators**

Twenty-five basic selections of tip speeds and capacities in direct drive models and sixty-four in V-belt drive models of Burt's new low contour spun aluminum centrifugal fan ventilators are detailed and illustrated in new engineering bulletin SPV-12. Page from the book shows detailed type of information.

Burt Manufacturing Co.

**196—Surface Unit Heaters**

Catalog 956 describes Grid cast iron steam heat transfer surface unit heaters, blast heaters, and radiators. Describes and illustrates one-piece construction. Included are air distribution charts, heating capacities, conversion tables, and specifications. This four-section catalog with tab index is well illustrated.

D. J. Murray Manufacturing Co.

**202—Bifurcator Fans**

Catalog DB-37-55, 16 pages, describes operation of the bifurcator fan, a split-housing fan that exhausts hot, corrosive, and flammable fumes. Use of the bulletin makes fan selection easy since it gives full data on fan laws and static pressure, velocity, pressure, and friction.

DeBothezat Fans, Division of American Machine & Metals, Inc.

**197—Industrial Radiant Heaters**

Bulletin PE-70 gives product data on both Vycor brand tubular heaters and Pyrex brand panel heaters. These are two types of industrial heaters for drying, baking, heating, and curing. Bulletin contains pictures of typical installations, exploded view of heaters, and installation illustrations. Specifications given.

Corning Glass Works.

**203—Ready-To-Run Fan Sets**

Catalog 517 describes a new line of V-belt driven Ready Units. Features of construction and available special features are outlined. Selector charts indicating volumes to 25,000 cfm and static pressures to $2\frac{1}{2}$ in. are shown in charts and graphs. Dimensions, capacities, shipping weights, and motor limits included.

Clarage Fan Co.

To order personal copies of these bulletins fill in the coupon on page 20.

HEATING & VENTILATING EQUIPMENT continued



204—Quiet Operating Fan

The *AcostaFan*, which features a *Flow-Nozzle* air foil wheel designed specifically for quiet operation, is described in Bulletin 592. Quiet zone selection tables make an automatic selection of the quietest possible fan. Capacities range from 6000 cfm to 220,000 cfm, static pressure 3 in. wg through 11 in. wg. *New York Blower Co.*



205—School Heating and Ventilating

Bulletin CC-601 provides school heating, cooling, and ventilating information, especially application of Lennox Comfort Curtain system. Covers research and air distribution, heat gain and loss. Heat source of warm air, hot water, steam, electricity, heat pump; use of outdoor air and mechanical cooling. *Lennox Industries Inc.*

HIGHWAY, BRIDGE & STREET MATERIALS



206—Open Metal Grid

Irving decking catalog F-300 contains illustrations, descriptions and engineering data on open metal grid bridge roadways, with many of the advantages inherent in this type of bridge roadway, such as light weight, cleanliness, drainage, safety, durability, strength, traction, and economy.

Irving Subway Grating Co., Inc.



210—Aluminum Beam Guard Rail

Bulletin 72-11230 introduces Alcoa's all-aluminum highway guard rail system. Design details and dimensions are shown in blueprint-type drawings. Specifications include description, material, strength tables, interchangeable parts, and installation. Application illustrations in full color. Sales offices listed.

Aluminum Company of America.



207—Suspension Bridge Data

Catalog D-943 contains technical data making possible preliminary calculations for comparative estimates between the suspension bridge and any other contemplated type. Includes formulas for determining cable and suspender lengths, cable tensions, erection calculations, and catenary formulas.

John A. Roebling's Sons Corp.



211—Pavement Inspector's Manual

Manual R12-3 is a concrete pavement inspector's manual, to aid the inspector in the discharge of his duties. Proper adjustment and use of mechanical and hand equipment are set forth. Includes list of items that should be checked before and during construction. Helps the inspector fulfill all requirements.

Portland Cement Association.



208—Highway Products and Services

Bulletin ADUCO-90-90811, a catalog which includes all products of United States Steel used in highway construction from grading to surfacing. Sections include products for construction equipment, drainage, bridges and bridge foundations, paving, safety equipment, and highway accessories. Well illustrated.

U. S. Steel Corp.



212—Traffic and Safety Equipment

This illustrated brochure describes Planet's new line of highway traffic and safety equipment. Included are overhead sign trusses, roadside directional signs, bridge railings, pedestrian overpasses, and the "Planoflash", a portable night construction warning signal that is more visible than those commonly used.

Planet Corp.



209—Steel Bridge Flooring

Illustrated four-page bulletin on open steel bridge flooring, includes detailed drawings of steel flooring, details of concrete floor plans, and field welding diagram. Also included are load tables and diagnosis of load distribution on four-way grid. Illustrations show ease of handling.

Kerrigan Iron Works, Inc.



213—Highway Railings

One of the most complete catalogs on this subject. Contains specifications, design data, details for 47 sizes and types of cast posts, dimensions, properties of rails, and other components. A valuable handbook for the consulting engineer engaged in the design of highway railings. Forty pages.

Michael Flynn Manufacturing Co.

HIGHWAY, BRIDGES & STREET MATERIALS continued**214—Interstate Highway Map**

Publication R-113 is a map of existing and future interstate and defense highways. This is probably the latest map of its kind and has been issued by the Portland Cement Association. Most recent interstate road numbers are shown. Designed to acquaint the public with location and size of the interstate system. *Portland Cement Association.*

**215—Steel Lighting Poles**

Bulletin 29 presents new designs and data covering steel *Monotube* lighting poles for streets, highways, parking lots, shopping centers, and other locations. Poles are engineered for properly mounting today's modern luminaires. Similar information available in Bulletin LS-30 covering aluminum poles.

Union Metal Manufacturing Co.

**INDUSTRIAL PROCESSING EQUIPMENT****216—Rod Mills**

Bulletin 25-C describes Hardinge Company's rod mills for fine crushing and grinding. General discussion of correct field of application for both wet and dry grinding. Included are design features and construction. Specifications include weights, sizes, rod charges, speeds, horsepower ratings, and other data.

Hardinge Co., Inc.

**217—Commercial Laundry Machines**

Illustrated brochure shows complete line of Cook commercial laundry machines, including 37 x 30 gas-steam-electric dryer, 25, 50, 75, 100-lb. washers, 20" and 26" extractors. Features *Washtette* supply injector and *Key-Matic* one-dial control for washers. Both timer and coin operated models. Complete specifications.

Cook Machinery Co., Inc.

**218—Knittel Crusher**

Bulletin 858 describes Knittel crusher with ring type double rotor. The literature features comprehensive technical and engineering data, specifications, diagrams, and illustrations. The unit offers an exclusive crushing action that increases capacity, crushes wet sticky material without danger of plugging.

Stephens-Adamson Mfg. Co.

**219—Annunciator Systems**

Catalog 659 presents the standard Scam line of annunciator equipment. Included is helpful engineering data, diagrams, and dimension drawings. In many cases the consulting engineer will be able to specify annunciator-alarm systems directly from this catalog. Sections on annunciator function and sequences.

Scam Instrument Corp.

**220—Processing Equipment**

Illustrated folder shows how multiple installation of Lynch *Morpac*, *Robo-Wrap*, and *Robo-Lift* automatic processing machines improved molding and packaging operations for a leading food manufacturer, increasing speed and productivity, using less floor space, decreasing rejects, reducing maintenance.

Lynch Corp.

**221—Titanium Welding Techniques**

Booklet 3 gives detailed information on fabrication and welding techniques for Titanium and Titanium alloy sheet. Forming is completely discussed and illustrated. Includes table of temperature ranges for forming. Also contains chart of properties of Titanium, bend factors, and formulas for forming.

Republic Steel Corp.

**222—Expansion Engines**

Bulletin 3600 B1 describes Worthington's low temperature reciprocating expansion engines for cryogenic applications to minus 452°F. These expansion engines are used to produce the low temperatures required to liquefy and separate gases. Bulletin furnishes cut-away sections, and other engineering information.

Worthington Corp.

**223—Process Equipment Preheater**

Brochure entitled "The Ljungstrom Air Pre-Heater for Process Equipment" describes the fuel economy possible with this regenerator. Table of comparative fuel and power costs and graph clearly show these economies. Explains how added furnace capacity gives increased production and higher quality.

Air Preheater Corp.

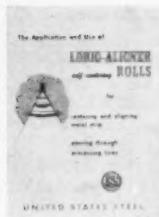


DIRECTORY OF ADVERTISERS' LITERATURE

INDUSTRIAL PROCESSING EQUIPMENT continued

224—Self-Centering Rolls

Bulletin ADUCO-78-78230 contains comprehensive material on the application and use of *Lorig-Aligner* self-centering rolls. This article by E. T. Lorig, chief development engineer for USS, includes operational diagrams and a description of rolls for centering and aligning metal strip on processing lines. *U. S. Steel Corp.*



225—Coin-Operated Automatic Washer

Illustrated bulletin shows *Waschette* coin-operated 25-lb washer suitable for installation in coin stores, apartment buildings, housing projects, and other applications. Complete specifications and features. Stainless steel model pictured, but machine available in enamel, either white or colored.

Cook Machinery Co., Inc.



226—Jaw Crusher

Double toggle, heavy duty jaw crushers for tough, abrasive, high compressive strength materials are described in booklet 17B6369. Ratings from 250 to 660 tons per hr. Principle construction features are described, including use of anti-friction bearings to reduce power consumption. Dimensions and ratings. *Allis-Chalmers.*



227—Mill Feed Control

Bulletin 42-A describes Hardinge's *Electric Ear* grinding mill feed control. This is an electronic device which automatically regulates the flow of feed material, wet or dry, to a continuous grinding or pulverizing mill, controlled by grinding sound level. Operating principles, data on application, and installation pictures. *Hardinge Co., Inc.*



INSTRUMENTS and CONTROLS

228—Pressure Transmitters

Bulletin RI-1825 (Supplement A) describes new Yarway differential pressure transmitter for operating remote indicators, controllers, or other electrically-activated receiving instruments. Describes and illustrates operation, design features, advantages, and operating specifications. Line drawing shows components. *Yarnall-Waring Co.*



229—Automatic Safety Controls

Bulletin FS-1 describes a dependable, moderately priced type of automatic control of safety device that makes or breaks electrical circuit when flow in a pipe starts or stops. Shows wide variety of uses—controlling signal devices, alarms, motors, burners, metering devices. Details typical use in air conditioning. *McDonnell & Miller, Inc.*



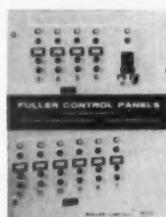
230—Process Control Instruments

Catalog 515 describes pneumatic instruments for the process industries manufactured by U. S. Gauge Division of American Machine and Metals, Inc. Indicating controllers for automatic control of pressure and temperature. Illustrations show how recorders operate, measuring elements, and bulbs and connections. *U. S. Gauge Division.*



231—Control Panels

Bulletin G-9 describes modern graphic panels for automatic handling of dry materials and process equipment control. Panels are designed and fabricated by manufacturer and are internally wired. Wiring diagram is furnished and supervision is normally furnished for start-up of system. Illustrated. *Fuller Co.*



232—Dens-O-Meter

Bulletin describes the Washington *Dens-o-meter* which assures accurate field tests for moisture-density of embankment and foundation soils. Five-Step operating procedure is shown in photographs and explained in captions. Sequence in line drawings illustrate characteristics during operation. Specifications included. *Charles R. Watts & Co.*



233—Float-Operated Controls

Sec. D1.1B describes several types of float-operated devices for use with boilers or tanks to actuate electric warning signals such as lights, bells, or sirens. Certain combinations provide fuel cut-out service also. Two and three light signals and electric vibratory horns are listed as accessories. Wiring diagrams. *Reliance Gauge Column Co.*



INSTRUMENTS & CONTROLS *continued***234—Electric-Pneumatic Systems**

Circular 372 describes system which combines electronic measurement of temperature with pneumatic operation of the controlled device. Consisting of electronic sensors and an amplifier transducer unit which converts the electronic temperature signal to a pneumatic output. Duct, room, outdoor applications.

Powers Regulator Co.

**235—Portable Detectors**

Bulletin M1 describes Tinker and Rasor's portable detector for locating bare spots in thin protective films. Widely accepted in the corrosion control and industrial painting industry. It is non-destructive, applied voltage never exceeds 67½ volts. Bulletin furnishes specifications, operating data, and prices.

Tinker and Rasor.

**236—Specifying Guide for Tank Gages**

Form 632 is a specification guide especially designed in handy folder form to assist consulting engineers to specify their choice of tank contents gaging systems for each project. Contains sample specifications for hydraulic system, and hydrostatic systems (manually operated and continuous reading).

Liquidometer Corp.

**237—Pressure Gauges, Needle Valves**

Catalog 76-G, revised, covers all types pressure, vacuum, and compound gauges. Covers Master-test series of extremely accurate test gauges, Master-gauge series, Quality series, and Standard series, gauges covering all requirements. Also includes needle (throttling) valves. Ranges, types, and dimensions.

Marsh Instrument Co.

**238—No-Freeze Liquid Level Control**

Bulletin R-31 describes and illustrates the new Magnetrol Model A-101 no-freeze winter-proofed liquid level control. Provides complete protection for outdoor water storage tanks. Bulletin includes advantages, operation, dimensions, specifications. Cutaway photograph illustrates the principle features.

Magnetrol, Inc.

**239—Hydrostatic Indicators**

New 88-page handbook prepared specifically for the convenience of consulting engineers. This book describes the complete line of hydrostatic liquid level and specific gravity indicators and controls, as well as accessory equipment. Includes discussion of the theory of hydrostatic measurement and engineering data.

Petrometer Corp.

**240—Pneumatic Control Centers**

Bulletin S-103 describes the functions, applications, and operation of centralized pneumatic controls for air conditioning, heating, and ventilating systems. The advantages of using pneumatic transmission are explained and the latest developments in control center instrumentation are shown in this 12-page booklet.

Johnson Service Co.

**241—Liquid Level Gages**

Catalog 36 describes Penberthy's complete line of liquid level gages, available for all requirements. Plastic-bound and tab indexed for easy reference, this catalog details flat glass reflex gages, gage valves, heating and cooling gages and valves, and accessories. Includes complete technical data and service parts.

Penberthy Manufacturing Co.

**242—Resistance Temperature Detector**

Bulletin 3047 describes the Edison resistance temperature detectors — stable, accurate, fast, sensitive, and rugged. Comparisons are made between the old type detectors and the new. Reliable temperature measurement is vital to modern industry. Operating principle, history, and advantages are included.

Thomas A. Edison Industries.

**243—Solenoid Valves**

Bulletin 506 new stock and selection guide lists the world's largest stock of solenoid valves for immediate delivery. Easy to select valve suited for your application. Valves are grouped under specific types — 2-way normally closed, 2-way normally open; 3-way; 4-way; manual reset and special purpose.

Automatic Switch Co.

**244—Compact Solenoid Valves**

Bulletin covers compact solenoid valves, Marsh Master-mite, in $\frac{1}{8}$ " and $\frac{1}{4}$ " sizes and ten orifice sizes, $3/64$ " through $1/4$ ", pressures up to 540 psi. Used on air, water, petroleum products, coolant, oxygen, hydrogen, and acetylene. Underwriter's approved for use on oxygen and hydrogen and as safety valves.

Marsh Instrument Co.

**245—Glass Tube Purge Meters**

Bulletin TP-1-RM, illustrated, describes W&T purge meter line for purge, vent, bleed, and other applications. Available with $1\frac{1}{2}$ in. or 3 in. scale, they will withstand toughest industrial use. Interchangeable parts. Suitable for flush panel mounting. Publication gives full technical data and complete specifications.

Wallace & Tiernan Inc.

DIRECTORY OF ADVERTISERS' LITERATURE

INSTRUMENTS & CONTROLS continued



246—Portable Hydroion Meters

New bulletin describes portable *Hydroion* meters manufactured by Carma Manufacturing Co. Designed to conveniently measure specific conductance of a solution in locations where electric power is not available. Gives ranges, increments, reading selector, and pertinent applications. Illustrated.

Carma Manufacturing Co.



247—Bi-Color Boiler Gauges

Bulletin 2044-A describes "Multi-Port" bi-color gauge MP 1050 for boilers operating at pressures up to 1050 psig. Water always shows green and steam red. Vision slot divided into series of round ports. This permits use of small glasses and small mica which are stronger and less sensitive to thermal stress.

Diamond Power Specialty Corp.



248—"Oiltight" Control Units

This publication describes standard duty, heavy duty, and "oiltight" control units and stations applicable for every industry. Complete information on applications, ratings, and design features are included. All types of control units, stations, enclosures, and "oiltight" controls are shown and described.

Allen-Bradley Co.



249—Electrical Controls

Engineering reference catalog 18A contains a complete line of standard Zenith electric controls and timing devices. Photos, diagrams, engineering data, and prices on automatic transfer switches, magnetic contactors, remote control switches, program clocks, automatic reset timers, cycle timers, and special controls.

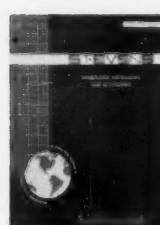
Zenith Electric Co.



250—Manometers for Plant and Lab

Catalog 2008 covers U-type, single- and multi-tube well-type, and inclined-tube *Manometers*, for measuring pressure vacuum, flow; draft gauges; indicating liquids; accessories. Explains operating principle and inherent accuracy. Discusses points to consider in selecting *Manometers* for specific applications.

King Engineering Corp.



251—Hydrologic Instruments

Short Form Catalog No. 23 summarizes the Stevens line of hydrologic instruments and accessories. Included are descriptions and photographs of Stevens liquid flow recorders and indicators, liquid level recorders, telemetering systems; servo controls, precipitation recorders and gages, and accessory equipment.

Leupold & Stevens Instruments, Inc.



252—Annunciator with Recorder

Bulletin 102A describes Panalarm's Model RA standard annunciator system with a highly accurate built-in automatic recorder. Gives a dependable, precise record of your equipment's operations. Advantages including exclusive features, and specifications. Photographs show installation, components, and operation.

Panalarm, Division of Panellit, Inc.



253—Control Guide for Engineers

Barber-Colman Company of Rockford, Illinois, has published an Automatic Control Systems Guide, F-8944, for consulting engineers. The guide discusses *Electronic* control systems and a selection guide for designing various types of automatic systems for air conditioning, heating, and ventilating.

Barber-Colman Co.



254—Automatic Metering System

Bulletin FL-56 describes Hetherington & Berner's *Fluidometer*, an automatic batch metering system. Adoptable to practically any liquid measuring problem. Equally accurate with high or low viscosities, eliminating waste. Shown in photo and diagram are direct control, remote control, dual valve, and multi-valve systems.

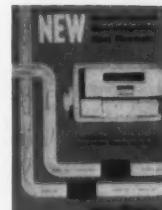
Hetherington & Berner Inc.



255—Annunciator System

Catalog 659 presents the standard Scam line of annunciator equipment. Included is helpful engineering data, diagrams, and dimension drawings. In many cases the consulting engineer will be able to specify annunciator-alarm systems directly from this catalog. Sections on annunciator function and sequences.

Scam Instrument Corp.



256—Gyro-Integrating Mass Flowmeter

Bulletin GEA-6925 describes a gyro-integrating mass flowmeter for accurate measurement of gas or liquid flow even with wide variations of pressure, temperature, density, or viscosity. No chart integration is needed. Units available for metering industrial gases up to 40,000 pph and liquids to 240,000 pph.

General Electric Co.



257—Pressure, Temperature Recorders

Catalog 800 describes the United States Gauge recorders for pressure and temperature. Contains quality and styling features, specifications and measuring elements, and mechanical construction features. Completely illustrated with pictures of the recorders and component parts. Dimensional drawings included.

U. S. Gauge Division.

INSTRUMENTS & CONTROLS *continued***258—Portable Holiday Detectors**

Bulletin EP describes Tinker and Raso's portable damp-climate, pulse type, holiday detector for surfaces coated or wrapped with high electrical resistance material. Adoptable for use on both large and small diameter pipe as well as flat surfaces. Bulletin furnishes specifications, voltage range, components.

Tinker and Raso.

264—Pressure-Type Air Meter

Bulletin describes the *Press-ur-meter*, newest device using the pressure method for measuring entrained air in concrete. Operation of this air meter is shown in pictures and captions. Features are listed along with facts about the *Press-ur-meter*. Air entrainment is explained and general specifications are given.

Charles R. Watts & Co.

259—Pneumatic Control Systems

Bulletin M-101 explains the principles of pneumatic controls for heating, cooling, ventilating, air conditioning, and industrial processes. Controllers and controlled devices are shown in detail. Bulletin also covers typical applications ranging from simple thermostat-valve arrangements to complex dual-duct control systems.

Johnson Service Co.

265—Material Level Indicators

Bulletin 1-5-C describes level indicators for dry, pulverized materials—model SG-4 for general purpose and SG-4X for use in hazardous dust locations. Vertical or horizontal mounting. Will control feeders, valves, elevators, and conveyors by starting or stopping the drive motor when predetermined level is reached.

Fuller Co.

260—Water Control Equipment

Bulletin 315 illustrates, and provides specifications for, the complete line of Sparling propeller-type main-line meters, recording instruments, and control equipment. Various applications, flow ranges, sizes, cut-away drawings, and installation information are all included. Pictured are production and test equipment. *Hersey-Sparling Meter Co.*

266—Safety Controls Data

Engineering data on operating and safety controls for a wide variety of jobs involving liquid level or liquid flow. Discusses 21 case studies of special applications of McDonnell float-operated switches and valves, and flow switches. Designed to suggest a dependable, economical answer to control problems. *McDonnell & Miller, Inc.*

261—Industrial Liquid Level Gauges

King-Gage Catalog 1010 gives details and specifications of hydrostatic gauges for measuring depth, volume, or weight of almost any liquid in any tank or processing vessel, under pressure or vacuum, from any desired location. Describes operation; shows applications in many industries; gives installation data.

King Engineering Corp.

**267—Solenoid Valves**

Catalog 444 lists and describes Atkomatic's solenoid valves, electrically operated valves for air, gas, liquids, and steam. Index gives type, specifications, and list prices. General operation is illustrated with cutaway. Line drawings show construction and operation of various types. Coil and flow charts included. *Atkomatic Valve Co., Inc.*

262—Liquid Level Indicators

Bulletin 2004 describes and illustrates hydrostatic liquid level indicators for tank measurement of fuel oil and other fuels in buildings, commercial establishments, and industrial plants. Listed are distinctive features, principle of operation, and dimensions. Diagram details installation procedures.

Petrometer Corp.

**268—Automatic Controls**

Catalog 860 lists mercury switch equipped controls for pressure, temperature, liquid level, and mechanical movement. Also offered are transformer-relays and mercury switches. Each control is illustrated with accompanying description, specifications, and engineering data. Drawings show control dimensions. *Mercoid Corp.*

263—Pressure Gauges

Catalog G58 introduces a comprehensive line of pressure gages for in-plant processing and general industrial applications. Available in numerous case styles and sizes including a completely safe gage case. Catalog designed for use by specifying engineers, making it easy to select the right gage at all times. *Kunkle Valve Co.*

**269—Liquid Level Controls**

Bulletin R-33 introduces the new non-metallic Magnetrol liquid level controls. Two models, NM-1 and NM-2, are featured. Describes applications of new non-metallic controls where liquids cannot tolerate the contamination of metals. List such liquids. Parts of controls in contact with liquids made of poly-vinyl. *Magnetrol, Inc.*

DIRECTORY OF ADVERTISERS' LITERATURE

INSTRUMENTS & CONTROLS continued



270—Tank Contents Gaging Systems

Suggested specifications for tank contents gaging systems — hydraulic, hydrostatic, and direct reading — are given in bulletin 463A. Model selection guides and pictorial diagrams are included, along with a list of liquids successfully gaged by Liquidometer systems, and principles of operation of each gage.

Liquidometer Corp.



271—Liquid Level Controls

Sec. D2.1C describes electrode-type liquid level controls performing from one to five or more functions are included under name *Levalarms*. Illustrates improved designs, explains principle of operation-water conduction between electrodes of varying lengths, use of transformer-isolated currents.

Reliance Gauge Column Co.

INSULATION & PROTECTIVE COATINGS



272—Stay-Dry Insulation

Bulletin FI-107 introduces *Stay-Dry* insulation for commercial applications from +35°F to +350°F. Contains illustrations of features, application specifications, suggested *Stay-Dry* thicknesses, available sizes and thicknesses for iron pipe and copper tubing, and a list of *Foamglas*' physical properties.

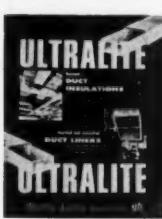
Pittsburgh Corning Corp.



276—Silicone Products

The forms, properties and applications of Dow Corning silicone products are reviewed in this 16-page brochure, 1-115. Of vital interest to consulting engineers and production-maintenance men are the silicone materials that resist the effects of time, heat, moisture, weathering, oxidation, and chemical attack.

Dow Corning Corp.



273—Long Textile Insulation

Revised catalog ULD describes the use of *Ultralite*, the long textile type insulation for duct wrap and duct liner. Characteristics of *Ultralite* duct liner, together with application methods, are listed. Facings available, including new gray fire resistant coating, shipping information, and specifications are given.

Gustin-Bacon Manufacturing Co.



277—Coal Tar Protective Tape

Hot coal tar protection in easy-to-apply tape form for pipe, pipe fittings and joints, conduit, cable, insulated pipe, tie rods. Material is heated lightly to soften the pitch, then spirally wrapped onto pipe surface. Tapecoat provides long-life protection that is equivalent to a hot-applied coal-tar pipeline coating.

Tapecoat Co.



274—Protective Asbestos Coating

Bulletin SL-8 describes fire-protection, acoustical control, anti-sweat, and heat-saving properties of sprayed *Limpet* asbestos, a simple spray-on blanket of 100% asbestos which adheres to all interior surfaces without hiding decorative details. Up to four hours fire-protection provided to beams and floors.

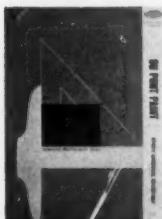
Keasbey & Mattison Co.



278—Duct-Sealing Tape

Bulletin 74-80 describes the new Johns-Manville *Dutch Brand* silver cloth duct-sealing tape. This tape has a vinyl-coated silver cloth backing and a quick-stick, tight-holding sensitive adhesive. Suited for forming, holding, and sealing air duct insulation in heating, ventilating, and air-conditioning.

Johns-Manville Dutch Brand Division



275—Masonry Block Primer

Bulletin A-7436 describes Du Pont's masonry block primer designed to give a smooth surface on porous masonry in a single coat. Information on application, thinning, coverage, drying time, topcoats, and colors. Picture compares block with three coats of conventional cement paint and one coat of masonry block primer.

E. I. Du Pont De Nemours & Co., Inc.



279—Coatings for Weather Protection

Bulletins M and MRC describe Foster's mastic coatings applied for weather protection of water absorptive materials for thermal insulation. The latter bulletin is a mastics reference chart including such data as description, coverage, drying time, service temperature, flash point, clean-up solvent, and other data.

Benjamin Foster Co.

INSULATION & PROTECTIVE COATINGS continued

**280—Chemical Resistant Enamel**

Bulletin A-7441 describes Du Pont's *Epoxy* chemical resistant enamel. Contains information on use, composition, application, mixing, thinning, drying, surface preparation, finishing systems, and colors available. Also lists features, interested industries, types of surfaces usually involved, and availability.

E. I. Du Pont De Nemours & Co., Inc.

**286—Specialized Adhesives**

Bulletins A and ARC describe Foster's adhesives used for lagging and insulation bonding. Gives facts and advantages of these specialized adhesives. The latter bulletin is a reference chart giving description, coverage, bonding time, service temperature, flash point, solvent for clean-up, and other pertinent information.

Benjamin Foster Co.

**281—Corrosion Prevention Tape**

File DF:T,1015-B describes Johns-Manville *Dutch Brand* polyvinyl pipe wrapping tape for the prevention of corrosion above and below ground. This unique product is pressure-sensitive and can be quickly and easily applied on the job. Data file features a complete coverage table and application procedures.

Johns-Manville Dutch Brand Division

**287—Asbestos Insulation**

Engineering manual F76-321 gives detailed information on Union Asbestos & Rubber Company's *Unibestos* pipe insulation. Precision production methods and rigid quality control described and pictured. Important advantages, installation photographs, comparison charts, application methods, and technical data.

Union Asbestos & Rubber Co.

**282—Ozone-Resisting Insulation**

Bulletin RCD 702 is a descriptive-type folder covering two of Rome Cable's ozone-resisting insulations — oil-base (Rozone) and butyl-base (Rozone A). Descriptions of these insulations are included along with information and specs on Rome's flame-retardant polyethylene sheathing material, thermoplastic Roseal. *Rome Cable Division of Alcoa.*

**288—Silicone Insulator Protector**

Bulletin 4-218 explains how Dow Corning 5 Compound protects insulators and electrical equipment bushings against excessive leakage, flash-overs, and service interruptions resulting from contaminated atmospheres or wet conditions. Photographs show how 5 Compound prevents formation of conductive paths.

Dow Corning Corp.

**283—Foamsil Insulating Material**

Bulletin FS-1 describes Foamsil, a new insulating and refractory material. Contains background information on this new material, which is 99% pure fused silica and has a practical operating range of -450 F to 2200 F. Material is unaffected by practically all commonly used acids. Physical characteristics outlined.

Pittsburgh Corning Corp.

**284—Butyl Rubber**

Twelve-page, two-color bulletin describes in detail Butyl rubber. Many applications of this rubber that stays "alive" are pictured. Many comparison graphs show effect of heat aging, electrical stability, shock absorption, sound damping, tear resistance, abrasion loss, gas permeability, and low temperature flexibility.

Enjay Co., Inc.

**289—Pipe Insulation**

"G-B Snap-On Pipe Insulation," eight-page booklet, describes characteristics and application data for one piece, fine-glass pipe insulation. Application specifications cover: plumbing, heating, insulation of valves and fittings, cold piping, dual temperature, and outdoor piping. Thickness charts are also included.

Gustin-Bacon Manufacturing Co.

**285—Polyurethane Insulation**

Data sheet describes the new low temperature insulation for the temperature range of minus 300° to plus 225°F. A 85% closed cell product weighing approximately 2.3 lbs per cu ft with *ak* factor of .15 at 70° ambient. Lightweight, rugged, easy to apply. Can be vapor-proofed with standard materials. *Union Asbestos & Rubber Co.*

**290—Protective Coating**

Tapecoat X is a coal tar protective coating in tape form for pipe, pipe fittings and joints, conduit, cable, insulated pipe, tie rods. Material is heated lightly with a torch, then wrapped onto pipe surface with one-half inch overlap. Provides protection on underground pipe equivalent to hot-applied coal tar. *Tapecoat Co.*

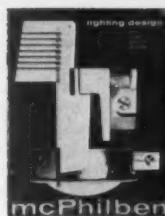
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LIGHTING FIXTURES & ACCESSORIES

**291—Exit Lights**

Bulletin 272E details all-aluminum, surface mounting exit lighting fixtures new in design and construction. Shows complete line of 6 in. letter exits. Features interchangeable wiring for incandescent or fluorescent lighting, glow-in-dark glass, shock resisting glass, stenciled metal fronts, and luminous bottoms.

Kirlin Co.

**297—Cast Aluminum Lighting Units**

Folio 60-1, a 12 page booklet, describes McPhilben's unique line of cast aluminum special purpose lighting units. Applications for vaportight, exterior, general interior use and directional signs. Includes specifications, drawings, and optional features to assist you in selection of quality lighting.

McPhilben Lighting, Inc.

**292—Fluorescent Lighting Ballasts**

This bi-monthly newsletter covers advances in ballasts for fluorescent lighting and the activities of the Certified Ballast Manufacturers Association. It reports the latest news of industry's progress in improving fluorescent lighting performance standards. Sent free to consulting engineers on request.

Certified Ballast Manufacturers Ass'n.

**293—Aluminum Troffers**

Catalog section 2G describes Miller's aluminum troffers for the new power groove lamp. Provides comfortable high footcandle lighting for commercial interiors at lower cost than ever before. Fixtures illustrated together with photograph of installation. Selector guide in chart form for various ceiling types.

Miller Co.

**298—Fluorescent Units**

A new economy unit designed to meet high lighting standards of modern classrooms, offices, stores and other commercial establishments. Available in either 35° x 25° or 45° x 45° units in 2 or 4 lamp arrangements. Bulletin AD 6888 furnishes full installation details and construction specifications.

Benjamin Electric Mfg. Co.

**294—Lighting Specifications Book**

RLM standard specifications book (1960) for industrial lighting units includes three new specifications for 1500 ma-units; D-4 fluorescent semi-direct medium high mounting, SD-3AL semi-direct aluminum, and SD-3PE semi-direct porcelain enameled units. Also many upward revisions of other existing specifications.

RLM Standards Institute.

**299—Incandescent Lighting Equipment**

Catalog 956 describes the incandescent lighting equipment manufactured by The Perfectlite Company. Catalog includes flush units, surface type box units, recessed units, hospital bed lights, night lights, indirect units, ceiling pan units, flush and surface gym units, and many others. Complete data given.

Perfectlite Co.

**300—Integrated Ceiling Lighting**

Bulletin describes Gibson's new Ortho-99 troffer, the flexible integrated ceiling lighting system. Plug in 40 to 240 foot-candles anytime with no additional wiring. Replace 2, 3, 4, or 6 tube fixtures in a matter of minutes to give the amount of light required. System is graphically shown and explained in detail.

Gibson Manufacturing Co.

**295—Indoor Luminaire Maintenance**

Safe low-cost floor-level servicing of high-bay luminaires is described and illustrated in Bulletin TH-57. The five basic requirements for a Thompson hanger installation, available hanger models, accessories, Underwriters' ratings, and range of applications also are outlined in detail. Completely illustrated.

Thompson Electric Co.

**301—Recessed Lighting Fixtures**

Bulletin OD-1036 describes the new UNI-FRAME Series of recessed lighting fixtures. Shows 24 combinations available for two box sizes. Fixture illustrations and drawings show application possibilities. Dimensional cross sections, design features and complete catalog listing are included in bulletin.

Day-Brite Lighting, Inc.

**296—Fluorescent Luminaires**

Bulletin 61-150-7 gives a full description of the Mainliner fluorescent luminaire. This line offers seven different modular sizes with shields of different diffusers, lens, and louvers. Bulletin is illustrated with photographs and dimensional drawings. Detailed installation and application information.

Westinghouse Electric Corp.

**302—Fluorescent Lighting Fixtures**

Bulletin 14 illustrates the new Gateway fluorescent fixture with concave Grateelite or Prismoid louvers. Units feature tubular designed side wings. Continuous one-piece 8' or 4' side wings. Bottom hinge from steel end plate for strength. Complete Gateway photometric data and engineering information included.

Edwin F. Guth Co.

LIGHTING FIXTURES & ACCESSORIES continued

**303—Ballast Application Guide Book**

Loose-leaf guide book GIZ-964 reviews the leading principles of ballast specification. Lists, by application, recommended ballast-lamp combinations with performance characteristics of appropriate General Electric ballasts. Gives prices, ratings, and general information. You will be billed \$5, including future revisions.

General Electric Co.

**309—Lighting Application Data**

Bulletin B-7253 contains basic recommendations and technical data for lighting applications for expressways or freeways; major arterial streets and rural trunk highways. Includes considerations and lighting requirements expected to exist by 1970. Valuable to consultants working on highway outdoor lighting.

Westinghouse Electric Corp.

**304—Fluorescent Ballast Distributors**

A revised list of electrical wholesalers who stock Advance fluorescent lamp ballasts is available in Bulletin 1201, Revised. Wholesalers listed stock popular Advance ballasts and will replace inoperative in-warranty Advance ballasts free of charge. The warranty policy of the company is explained.

Advance Transformer Co.

**305—Light and Air Diffusers**

Catalog OD-1040 describes light and air diffusers in one unit. Line drawings show construction and operation of various types. Includes selection of illumination levels, installation planning, and fundamentals of fixture selection. Fixtures illustrated with specifications. Air distribution and lighting performance data.

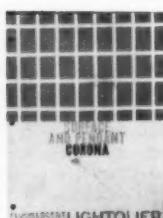
Day-Brite Lighting, Inc.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.

**310—Vapor-Tight Light Fixtures**

This 48 page catalog lists hundreds of vapor-tight aluminum fixtures for providing protected lights in both outdoor and indoor locations. Fixtures are suitable for bracket, ceiling, pendant, or corner mounting and give trouble-free performance in rain, ice, spray, dust, smoke, moisture and other conditions.

Killark Electric Mfg. Co.

**306—Shallow Fluorescent Fixtures**

Catalog 32, "Surface and Pendant Corona", describes new shallow fluorescent unit which combines walnut and birch frame with expansive luminous styrene panel. Many sizes, distinctive appearance. For use wherever handsome lighting is called for—offices, residences, board rooms, reception areas. Full details.

Lightolier Inc.

**311—Outdoor Luminaire Maintenance**

Safety and cost-saving features, typical installations, operating procedures, and available models of Thompson Servisafe pole and bracket units are covered in Bulletin PWB-59. Servisafe products permit fast hazard-free ground-level luminaire servicing by one man to assure low-cost year-round lighting efficiency.

Thompson Electric Co.

**307—Non-Combustible Diffusers**

Bulletin 45 describes the new Guth NC (non-combustible) Gratelite louver diffuser for overall electric ceiling lighting. NC Gratelites are UL Listed as non-combustible and available in new 2' x 2' modules. Gratelites are molded of a non-combustible plastic with $\frac{3}{8}$ " open cubes. Layout and installation data.

Edwin F. Guth Co.

**312—Surfaceline Luminaires**

Catalog Section 1, Pages 25 through 36, describes Miller's commercial Surfaceline fluorescent luminaires. These shallow fixtures, with hinged doors, come in sizes 1' x 4', 1' x 8', 2' x 2', 2' x 4', and 4' x 4'. Outline dimensional drawings, specifications, application data, illumination calculations, and features.

Miller Co.

**308—Industrial Lighting Levels**

New, Illuminating Engineering Society's "Recommended Industrial Lighting Levels" are made available in pamphlet form by the RLM Standards Institute. A reference must for those concerned with planning lighting or re-lighting projects of industrial plants, utilitarian locations, and other facilities.

RLM Standards Institute.

**313—Modern Fluorescent Fixtures**

Bulletin announces the Venus lighting fixture by Gibson designed for contemporary offices and schools. Set up in Uni-Race system for simple fixture plug-in. Fixtures hug ceiling. Molded plastic ends in several standard colors to blend to any decor. Installation data includes dimensions of Uni-Race and fixture.

Gibson Manufacturing Co.

To order personal copies of these bulletins fill

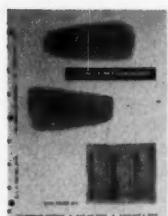
LIGHTING FIXTURES & ACCESSORIES continued

**314—Plexiglas Diffusers and Lenses**

Bulletin PL-399 covers use of *Plexiglas* acrylic plastic for diffusers and lenses in lighting equipment. Lists grades, properties, colors, sizes. Includes light-transmittance and UV-transmittance graphs, spectrophotometric curves, design and installation details, distribution curves and coefficients of utilization data. *Rohm & Haas Co.*

**315—Industrial Lighting Fixtures**

Hard cover, 3-ring binder contains data sheets describing all types of commercial and industrial, fluorescent and incandescent lighting fixtures. Each model is illustrated. Includes complete specifications, schematics, catalog numbers, and contractor's prices. Also includes outdoor fluorescent fixtures and accessories. *Wheeler-Fullerton Lighting Division.*

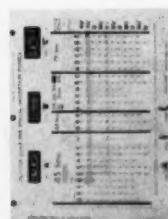
**316—Contemporary Lighting**

Bulletin 59-C describes contemporary lighting manufactured by The Perfectlite Company. Includes square tapered bowl, exposed conduit, hinged band, hinged pendant, high intensity outdoor, prismatic lens, close up pans, and many others. Complete specification, dimensions and line drawings of construction. *Perfectlite Co.*

**317—Fluorescent Fixtures**

AD-6856 introduces a companion fixture to the popular Catalina series. General construction identical to Catalina except C-2 features a patented, low-brightness, polystyrene lens in place of the Catalina louver. Designed to blend into the latest architectural decor with its flowing lines of light. *Benjamin Electric Mfg. Co.*

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.

**318—Directional Signs Selector**

mcPhilben's pre-calculated selector guide will assist you in fitting special wording inscriptions such as Cashier, Bar, Rest Room, Laboratory and others in any of mcPhilben's standard directional units. Chart provides choice of 3 different styles of type specimens and letter size according to wording and fixture. *mcPhilben Lighting, Inc.*

**319—Fluorescent Lamp Ballasts**

Bulletin GET-922K gives installation suggestions and operating characteristics for GE fluorescent lamp ballasts. Contains chapters on starters, various types of ballasts, and equipment for dc operation. Photographs, line drawings and wiring diagrams are used to amplify the text. Service and sales locations listed. *General Electric Co.*

**320—Fluorescent Lamp Ballasts**

"How Fluorescent Lamp Ballasts that Bear the CBM Emblem Insure Your Lighting Investment" is a 16-page illustrated booklet. The booklet explains how the Certified Ballast Manufacturers Association's ballast specifications covering lighting performance benefit all persons concerned with fluorescent lighting. *Certified Ballast Manufacturers Ass'n.*

**321—Commercial-Industrial Fixtures**

Bulletin V-810 describes a versatile line of commercial-industrial fixtures available for all lamp types, with several degrees of louver shielding, and in steel, aluminum, and plastic. Over 100 combinations provide ample selection for effective and economical direct-indirect lighting. Diagrams and pictures included. *Sylvania Lighting Products Inc.*

**322—Recessed Lighting Fixtures**

Catalog 79 shows large line of recessed lighting fixtures. Included are both incandescent and fluorescent. Over 300 stock models including surface mounted types. Contains information on optional features, finishes, installation. Also includes technical data and quick layout intensity charts. Completely illustrated. *Kirlin Co.*

**323—Recessed Incandescent Fixtures**

Colorful new brochure 31 describing Lightolier's line of recessed incandescent downlighting, just released. Construction features are detailed with special emphasis on the exclusive *Duo-Style* trim flange, the new *Multi-Groove* baffle, the *Prismatex* low brightness lens. Complete technical data and ordering information. *Lightolier Inc.*

**324—Fluorescent Lamp Ballast**

Bulletin B-1000, superseding B570-10, gives data and prices of Jefferson's fluorescent lamp ballasts. Included are wiring diagrams and complete specifications on rapid start ballasts of 60 cycle, normal power, and high power. Sound control chart helps you make the proper selection of lamp ballast. Characteristics. *Jefferson Electric Co.*

MATERIALS HANDLING & STORAGE FACILITIES**325—Pneumatic Vibrators**

Catalog 109 describes the complete line of Cleveland air and electrically operated vibrators. Available in a full range of types and sizes capable of shaking anything. Completely illustrated with pictures of each type of vibrator, cutaways, and vibrators in use. Complete specifications with engineering data sheet. *Cleveland Vibrator Co.*

**326—Conveyor-Elevators**

Bulletin 358 describes Redler *En Masse* conveyor and elevators. Features comprehensive technical and engineering data, specifications, diagrams, and application photographs. Redler conveyor elevators can be applied horizontally, around bends, on inclines, and vertically to convey pulverized, granular, small lump, and flaked. *Stephens-Adamson Mfg. Co.*

**327—Automatic Weighing Systems**

Catalog 14 describes the W-C line of unitized weighing components, and their automatic weighing-system applications. Photographs and schematics are used to explain operation of components. Includes sections on control instrumentation and typical system applications. Complete selection information. *Weighing & Control Components, Inc.*

**328—Monorail Cars**

Page reprinted from the St. Louis Post-Dispatch tells story of how monorail cars distribute merchandise in a St. Louis store. Shows how the CM *Telematic* electronically controls the flow of merchandise. Important destination points are pictured with explanatory captions. Layout of the system included. *Columbus McKinnon Chain Corp.*

**329—Custom Engineered Cranes**

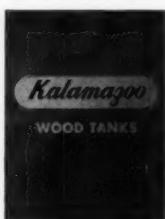
A new 12-page catalog covering in detail custom-engineered Conco overhead electric traveling cranes, including various bridge types and various electric trolley hoist types, as well as specially designed handling equipment employing crane principles and components. Illustrated with drawings and pictures. *Conco Engineering Works.*

**330—Automatic Bulk Handling**

Bulletin 531, "New Techniques for Automatic Bulk Handling," is a 12-page report covering latest methods of pneumatic conveying. It details techniques for centralized automatic control, flow control, and bulk materials distribution throughout production. Installations are pictured. *Dracco Division of Fuller Co.*

**331—Trackmobile**

Bulletin 245 describes in four full-color pages the important role played by a Whiting *Trackmobile* and a unique Whiting radial transfer table in the operation of Union Tank Car Company's unusual circular maintenance shop. Full description of the shop shows why it is considered one of the most advanced. *Whiting Corp.*

**332—Wood Tanks**

Eight-page bulletin 655-W explains why wood tanks can meet conditions other types of tanks cannot. It describes round, rectangular, and special tanks, as well as vats, boxes, sinks, and flumes. Lists possible uses for each along with the type of hardware and lining available, and gives installation photographs. *Kalamazoo Tank & Silo Co.*

**333—Building Elevators**

Catalog 534-C, a 20-page pictorial presentation in color, illustrates many important buildings equipped with Haughton Elevators. Office buildings, hospitals, hotels, apartments, industrial plants, and special-purpose structures are pictured. A complete listing of Haughton branch offices is included. *Haughton Elevator Co.*

**334—Conveyor and Elevator Belting**

Bulletin 170 describes C/R (cotton/rayon) conveyor and elevator belting. This belting is available in light, medium, and heavy duty, as well as chemical and fire resistant service. Comparison tests cotton/rayon versus cotton/nylon are given. Case history of C/R belt application. Specifics and advantages of C/R belting. *Hewitt-Robins, Inc.*

**335—Car Pullers**

Ten-page bulletin L-6 shows capstan type car puller for moving cars a short distance using manila rope. Three styles of drum car pullers for heavy duty car moving, shuttle work, or for servicing very large areas are also listed, as well as barge movers for shifting barges back and forth during unloading. *Clyde Iron Works, Inc.*

**336—Moving Sidewalks**

Bulletin 457 describes *Speedwalk* and *Speedramp* passenger conveyor systems from Stephens-Adamson. The literature presents comprehensive technical data, specifications, and illustrations of belt support and balustrade types. Also handrail and balustrade details, dimensions, and installation of moving sidewalks. *Stephens-Adamson Mfg. Co.*

MATERIALS HANDLING & STORAGE FACILITIES *continued*



337—Lift Tray Elevator Conveyors

Case History describes how Lynch Robo-Lift tray elevator conveyors and bucket conveyors help move cartons for the C. F. Mueller Company, this nation's largest macaroni manufacturer. Gives problem, requirements, solution, and results. Conveyor lines are illustrated in photographs and line drawings.

Lynch Corp.



338—Tank Designing Data

Bulletin TC-155 is a handy reference book containing tables, area and volume formulas, decimals of an inch and foot, tile shapes, standard reinforcing bars, wood pulp fibre in solution, capacities of tanks, conversion factors, and other information for the pulp and paper and chemical process industries.

Stebbins Engineering and Mfg. Co.



339—Materials Classifying Systems

Bulletin describes two types of classifying systems, both combining high efficiency with low power requirements and moderate cost. Units separate dry fine powdered or fibrous material from coarse within a fine product range of 10 to 400 mesh. Power requirements from 0.04 to 0.5 fan hp per ton of feed per hour.

Buell Engineering Co., Inc.



342—Bulk Handling Equipment

Catalog 7 illustrates and describes the modern method of bulk handling granular materials. Portable metal containers form the heart of the system used to solve both in-plant handling problems or in making inter-plant bulk shipments by truck, rail, or water. Fabricated from aluminum, stainless steel or carbon steel.

Tote System, Inc.



343—Industrial Storage Systems

Catalog 9129 gives construction details, sizes and capacities of Marietta industrial silos. Line drawings show construction details and photographs show installations. Complete information on Marietta's construction service. Shows the four types of concrete staves offered.

Marietta Concrete Division

American-Marietta Co.



344—Catenary Carriers

Bulletin 260 describes new Flexiroll catenary belt conveyor carrier from Stephens-Adamson. Offered in 18", 20", 24", 30", and 36" belt widths, provides true catenary suspension for the conveyor belt under all load conditions. Bulletin features engineering specifications, technical data, construction, and application details.

Stephens-Adamson Mfg. Co.



345—Vibrating Feeders

Bulletin 169 describes the Eliptex extra heavy duty vibrating feeder. This feeder is built to withstand severe battering in tough service involving unusually large and heavy materials. The advantages of this feeder are listed and the principle of operation explained. Standard specifications given and installations illustrated.

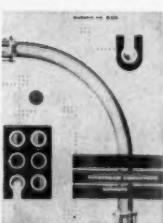
Hewitt-Robins, Inc.



340—Revolver Cranes

Catalog 400-R-4 describes American revolver cranes for handling heavy materials. Capacity of 400 tons; adaptable to gantry, fixed, or barge mounting; for use with hook, bucket, magnet, or pile hammer. Contains many illustrations of American revolver cranes at work in varied situations. Typical assemblies shown.

American Hoist & Derrick Co.



341—Airstream Conveyors

Bulletin 530 presents more than a dozen illustrated examples of how Airstream conveyors are used for efficient dry bulk material handling in a variety of industries. Described is a complete range of conveyor system components, and accessories with specifications. Line drawings show functions and conveyor types.

Dracco Division of Fuller Co.



346—Power Hoists

Bulletin 34A, 20 pages, describes the Clyde line of electric, gasoline, and diesel hoists. Gives construction details of medium capacity hoists of various line pulls. Also includes information as to selecting the hoist, information required for hoist quotation, and table of drum cable capacities. Available accessories are listed.

Clyde Iron Works, Inc.



347—Elevator Systems

Catalog SW-1 describes the complete line of Haughton Elevators, with special detailed information given on Haughton "Auto-Signmatic" systems for complete automation of multiple-unit elevator groups. Includes recommended sizes and dimensions for passenger, freight, hospital elevators, and dumbwaiters.

Haughton Elevator Co.

MATERIALS HANDLING & STORAGE FACILITIES *continued***348—Automatic Handling Systems**

Catalog 67-A describes, illustrates (photographs and diagrams) engineered and automated handling systems. The 16-page "Plan with Planet" brochure also illustrates equipment for bulk and unit materials, automated and special handling machinery, and foundry equipment. Describes Planet's creative service.

Planet Corp.

**352—Overhead Conveyors**

Bulletin 159 describes *Power-Flex*, the CM power and free conveyor system. Construction and operating features of rail, chain, and trolleys are explained and pictured. Typical *Power-Flex* installation with *Telematic* dispatch control is diagrammed. Complete general specifications and customer service. *Columbus McKinnon Chain Corp.*

**349—Curve-Crown Pulleys**

Bulletin 558 describes *Curve-Crown* welded, all-steel pulleys. The literature features comprehensive technical and engineering data, specifications, diagrams, and illustrations on the S-A *Curve-Crown* welded, all-steel pulley. This revolutionary design offers maximum belt training effect and minimum belt wear.

Stephens-Adamson Mfg. Co.

**353—Car Thawing Equipment**

Bulletin 168 explains the principles of infra-red heat rays and how they can be harnessed to melt frozen bulk material, thereby speeding up the unloading of railroad cars in wintry weather. Various applications are pictured and several case histories given. Features and specifications of different models included.

Hewitt-Robins, Inc.

**350—Tanks and Chests**

Kalamazoo vitrified glazed tile tanks and chests are described in four-page bulletin 1-55-T. Drawings and photos show how the two types of tile blocks available provide flexibility of wall design. Types, sizes, design, erection, and cost are discussed, and typical installations in industry are pictured.

Kalamazoo Tank & Silo Co.

**354—Conveyor Scale Systems**

Catalog 60 discusses W-C conveyor scale systems, their components and applications. Method of operation and performance data are given for each component. Includes information on use or systems for automatic control purposes, and gives available instrumentation. Completely illustrated.

Weighing & Control Components, Inc.

**351—Materials Handling Equipment**

Sixteen-page, two-color bulletin 246 offers a definitive look at all Whiting materials handling equipment — overhead cranes, *Trameam* and *Pressuregrip* handling systems, and *Trackmobiles*. Fully illustrated booklet describes many outstanding design features of each product and shows how each is being used. *Whiting Corp.*

**355—Overhead Traveling Cranes**

Bulletin 500A covers Conco custom-engineered overhead electric traveling cranes, of double girder construction. Can be furnished in a wide range of capacities and spans. Also included are hand-powered overhead traveling cranes, hand-powered and electric hoists.

*Conco Engineering Works,
Division of H. D. Conkey & Co.*

MECHANICAL POWER TRANSMISSION**356—Gears of all Basic Types**

Bulletin G-127 is a comprehensive catalog of various types of gears and power transmission manufactured by Philadelphia Gear Corporation. Illustrated are types of gears and gear cutting and finishing operations. Complete engineering data to assist in the selection of proper gear. Tables and specifications. *Philadelphia Gear Corp.*

**357—All Types of Gears**

A 20-page catalog describes in general the kinds and sizes of gears manufactured by this company. Its contents deal with spur gears, bevel gears, helical gears, worm gears, racks, nonmetallic gears, sheaves, sprockets, special machinery of which gears form a part. Illustrated with photographs.

Earle Gear and Machinery Co.

DIRECTORY OF ADVERTISERS' LITERATURE

MECHANICAL POWER TRANSMISSION continued



358—Centrifugal Pump Drives

Right-angle solid shaft gear drives, for centrifugal pumps and industrial use — cooling tower installations, barge service, sewage disposal, fire and flood control — manufactured in a wide range of models to meet specific requirements, are described and illustrated with engineering details in eight-page catalog 29.

Johnson Gear & Manufacturing Co., Ltd.



363—Speed Reducers

A sixteen-page illustrated catalog, describing speed reducers as applied to operating machinery, particularly bridge machinery, is available. Outlined are specifications, service factors, horsepower ratings, and dimensions of the particular units illustrated. Also deals with gasoline powered units.

Earle Gear and Machinery Co.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.



359—Gearmotors

Bulletin 51B9172 describes gearmotors available from $\frac{1}{4}$ to 100 hp. Bulletin covers integral and all-motor types including right angle as well as special designs. Allis-Chalmers complete line permits users and original equipment manufacturers to select just the right gearmotor for a particular need.

Allis-Chalmers



364—Motor Reducer Drives

Fully illustrated booklet B-7223, 33 pages, includes recommendations, ratings, dimensions, and other application data to assist the consulting engineer in selecting the proper gearmotor or package motor reducer drive for his particular applications. Describes *Moduline* gear units for maximum adaptability.

Westinghouse Electric Corp.



365—Fluid Drives

Bulletin A-719 describes American-Standard's *Cyrol* fluid drive for forced draft fan, centrifugal compressors, and other applications. Principles of fluid drive explained and illustrated with photographs and schematics. Installations, advantages, components, selection charts, dimensions included. Ordering data.

American-Standard Industrial Division



360—In-Line Helical Speed Reducers

Bulletin J-18 contains technical information on the Jones In-Line and Right Angle speed reducers. In-Line sizes range from .077 to 147 hp and ratios from 5:1 to 1528:1. Right Angle sizes from .058 to 23.5 hp and ratios from 20.9:1 to 2777:1. Design features, selection procedures, and complete specifications are given.

Hewitt-Robins, Inc.



366—Gears, Reducers, Fluid Mixers

"Power Thrifty" bulletin describes briefly all the products manufactured by the Philadelphia Gear Corporation. Listed are various types of power transmission, valve controls, fluid mixers, mechanical couplings, and industrial gears. Each product listed is illustrated and described. Cutaways show construction.

Philadelphia Gear Corp.



361—Flexible Gear Couplings

Advantages and typical applications of flexible gear couplings are pictured and described in 16-page catalog C-5, "The Revolutionary New Sier-Bath Flexible Gear Couplings." Couplings are available in standard, vertical millmotor, floating shaft, spaced type, and in many special purpose types.

Sier-Bath Gear & Pump Co., Inc.



362—Gear-Type Couplings

Catalog 878-M65 describes the complete line of Fast's self-aligning, gear-type couplings and acquaints you with both standard and special couplings. The Fast principle is explained and cutaways show components and operation. All types of couplings are illustrated with application explanations. Special designs.

Koppers Co., Inc.



367—Turbine Pump Drives

Bulletin 31 describes Johnson's right angle turbine pump drives, in standard and combination drive installations, in a wide range of models to meet specific requirements of prime movers and pumps. Introduces new *Redi-Torq* automatic combination drive. Includes illustrations, power ratings, and average efficiencies.

Johnson Gear & Manufacturing Co., Ltd.

PIPING, VALVES, & PLUMBING SUPPLIES



368—Pipe Drilling Machine

Bulletin W-8881 describes the Mueller CL-12 drilling machine, which drills holes to 12" in size in pipe under pressure. This machine has automatic feed with indicator, automatic travel control and can be either hand or power operated. Features are illustrated and described. Specifications included.

Mueller Co.



374—Jet Apparatus

Bulletin J-1 describes the various kinds of jet apparatus manufactured by Schutte & Koerting for syphons, eductors, heaters, blowers, exhausters, compressors, scrubbers, condensers, pumps, and other types of equipment. Each application explained with cutaway drawings showing operation. Gives details.

Schutte & Koerting Co.



369—Entrainment Separators

Bulletin 810A contains information on low cost centrifugal "T" type entrainment separators. Explains the advantages of the new type separator. Included are selection and capacity charts for both air and steam, complete specifications for three types of separators, and charts of separator and trap recommendations.

Wright-Austin Co.



375—Two-Bubbler Fiberglass Fountain

Bulletin S-185 gives specifications and dimensional drawings for Haws new wall-mounted drinking fountain, Model 10F. It is of lightweight reinforced fiberglass plastic, heat and pressure laminated, vacuum molded. In white, or 5 decorator colors at no extra cost. Haws anti-squirt, vandal proof heads featured. *Haws Drinking Faucet Co.*



370—Cone Valves

Consultants concerned with valves for industrial application, power plants, and water and sewage works will find handbook 02B2555 a must. Discusses what type of valve to use where, and why. Selection data on a broad line of cone-type valves includes descriptions, performance curves and specifications.

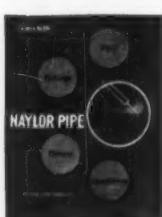
Allis-Chalmers.



376—Automatic Penton-Coated Valves

Bulletin 802D describes Rockwell's compact, diaphragm-disc type, valve, Penton coated for corrosion resistance, with pneumatic operator. A low cost packaged unit resistant to most chemical fluids to 180°F. Features are outlined. Line drawing shows operation of automatic valve. All valves illustrated.

W. S. Rockwell Co.



371—Lightweight Pipe and Fittings

New 8-page condensed catalog summarizes complete line of Naylor lightweight pipe, fittings, flanges, and connections. Lists typical applications. Includes standard specifications on pipe from 4 to 30 inches diameter, together with details on standard fittings and flanges. Covers couplings for pipelines. *Naylor Pipe Co.*



377—Steel Couplings and Steel Pipe

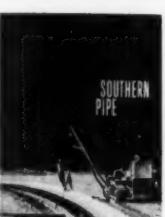
This new bulletin gives sizes, lengths, threads, weights, and carton contents of merchant, half and API line pipe couplings plus other information including complete specifications on standard, extra strong, double extra strong and structural pipe. Illustrated and printed in two colors on durable stock. *Wheatland Steel Products Co.*



372—Liquid Strainers

Bulletin 6 deals with liquid strainers, single and duplex, for pressures from gravity to 900 psi. Capacities from 6 to 7500 gpm of water or 50 viscosity oil at 6 psi pressure drop. Mesh size 8 to 200, depending on liquid and contaminant. Strainer basket catches all contaminant; none is left in shell or piping.

William W. Nugent & Co., Inc.



378—Southern Pipe Facilities

Bulletin SP-13-60 outlines the facilities of Southern Pipe Division of U. S. Industries, Inc. Offered is a complete line of steel pipe, lined and coated, for water, oil, and gas transmission. Fabricated to specifications in sizes from 3½ in. to 48 in. Complete story of Southern Pipe's facilities with pictures.

Southern Pipe Div., U. S. Industries, Inc.



373—Valve Catalog

This new valve catalog digest furnishes the latest coverage of the OIC bronze, iron, cast steel, forged steel, and lubricated plug valve lines in a condensed form. Classified by type and pressure class, and illustrated, this edition also includes face to face dimensions for each size and type of valve listed.

Ohio Injector Co.



379—Vitrified Clay Pipe

Jointed vitrified clay pipe known as *Amvit*, with a built-in mechanical joint made from polyvinyl chloride, is described in four-page folder. Advantages such as infiltration prevention, quick installation, immediate backfilling, better flow, shock absorption, and quick testing in the field are pointed out.

American Vitrified Products Co.

DIRECTORY OF ADVERTISERS' LITERATURE

PIPING, VALVES & PLUMBING SUPPLIES continued



380—Pyrex Drainline Systems

Bulletin PE-30 describes Corning Glass Works' Pyrex brand lifetime drainline system, guaranteed against corrosion and leakage for the life of the building. Specifications, fittings, and sizes are shown in table form and diagram. Simple installation procedures illustrated and described. Distributors listed.

Corning Glass Works.



381—Plastic Pipe Systems

Handbook 1159 describes plastic ball valves, check, foot, 3-way cock, needle, and globe valves made in five basic materials to handle a wide range of corrosive chemicals at temperatures up to 250° F. Working pressure at various temperatures charted and five basic materials rated as to chemical resistance.

Chemtrol.



382—Rubber Seat Butterfly Valves

Bulletin 10J is a new catalog describing the new Monoflange Mark II rubber seat butterfly valve. The catalog has been designed to be the ideal working tool for engineers and users of this type equipment. Complete specifications, flow data, certified drawings, weights, freight rates, and prices are included.

Henry Pratt Co.



383—River Crossing Pipe

Booklet L-115 describes American Molox ball joint pipe for river crossings and other difficult installations. Map shows various locations of installations. Gives description, suggestions for use, method of assembling. Many pictures are used showing actual installing of pipe. Complete specifications on all diameters.

American Cast Iron Pipe Co.



384—Butterfly Valves

Bulletin 5904 is a comprehensive 36-page catalog on Darling-Pelton rubber seated butterfly valves and operators. Catalog contains information on Darling-Pelton valves, designed in accordance with AWWA specifications for hydrostatic operating pressures up to 125 psi and velocities up to 16 feet per second.

Darling Valve & Manufacturing Co.



385—Stainless Steel Strainers

Bulletin SS-143 describes Strong's new line of all-stainless steel (Type 316) strainers. Stock sizes are $\frac{1}{2}$ " to 2" in socket weld or screwed connections. Protects high pressure and high temperature steam, liquid, gas, or chemical lines. Sizes, pressure and temperature ranges, specifications, and prices are included.

Strong, Carlisle & Hammond.



386—Solenoid-Operated Valves

Bulletin S-1 describes Atkomatic's new full ported-direct lift solenoid operated valves. Available in bronze or stainless steel. Port sizes to 3", pressures from zero to 3000 psi, temperature range from minus 350° to plus 500°F. Construction features, operation data, performance data, dimensions, and prices included.

Atkomatic Valve Co., Inc.



387—Steel Fittings

Catalog H-1 provides information about the complete "Husky" line of low-pressure 150 lb. carbon steel fittings: straight tees, 90° elbows, 45° elbows, and reducers. Practical advantages of "Husky" fittings are included. Also shown are Schedule 40 and Schedule 80 high pressure specification tees. Specifications.

NIBCO Inc.



388—Surface Wash Water Valves

Bulletin W-17 describes valves specially made for surface wash water application on filters and for control of water flow to filters. Valves may be controlled from operating table by electricity, air, or water. There is no working against line pressure. Instead, line pressure against piston operates valve.

Golden Anderson Valve Specialty Co.



389—Pneumatic Valves

Illco Matic Valve bulletin V-159 describes new line of all plastic, pneumatically operated valves with integral piston type operators. Valves are recommended for automatic or remotely operated systems involving the handling of de-ionized or distilled water, or corrosive chemicals. Both open and closed.

Illinois Water Treatment Co.



390—Butterfly Valves

Condensed Bulletin 50-1 illustrates wide selection of body designs and ratings of Continental butterfly valves. Cross index system permits quick selection of valve best suited for any requirement or application. Bulletin also shows several special designs made to handle unusual problems.

Continental Equipment Co.



391—Safety and Relief Valves

Catalog 53 describes safety and relief valves in brass, bronze, iron, steel, stainless steel, and aluminum; for air, gas, steam, and liquid relief; $\frac{1}{4}$ through 8 in. to 15,000 psig. Includes suggested applications, relieving capacity data, and illustrations of typical units. Navy approved type valves featured.

Kunkle Valve Co.

PIPING, VALVES & PLUMBING SUPPLIES continued

**392—Water Works Brass Goods**

Water works brass goods bulletin WW-58 illustrates and describes McDonald water service products. Included are curb stops, corporation stops, goosenecks, meter stops and couplings, service pipe couplings, and extension service boxes. Each product offered is pictured with description and necessary specifications.

A. Y. McDonald Mfg. Co.

**393—Insulated Piping Systems**

The new edition of the Ric-wil product catalog covers construction features for prefabricated, insulated piping systems for steam, hot water, oil, or refrigeration distribution lines. Types of systems covered include *Hel-cor*, *Undine*, *Type J*, and cast iron. Prefabricated accessories are also included.

Ric-wil, Inc.

**394—Diaphragm Control Valves**

Bulletin E-657A describes Fisher diaphragm control valves with iron, steel, or alloy bodies for all temperature, pressure, and corrosive conditions. Direct and reverse acting spring and pressure balanced top-works are listed and a section providing tabular material to aid in valve selection is included.

Fisher Governor Co.

**395—PVC Pipe, Fittings, and Valves**

Bulletin of engineering information on PVC plastic pipe, fittings, and valves. Specification, design, and installation information is included as well as a comprehensive corrosion resistance comparison chart for seven types of plastic pipe carrying 162 chemicals. Charts show fluid and gas flow characteristics.

Kraloy Plastic Pipe Co., Inc.

**396—Jacketed Pipe and Fittings**

Bulletin J-57 describes pipe, welded steel fittings, spring loaded plug valves, and valves all jacketed, manufactured by Hetherington & Berner Inc. Different types of valves and fittings are illustrated together with cutaway photographs showing construction and operation. Also jacketed pumps and flexible hose.

Hetherington & Berner Inc.

**397—Lubricated Plug Valves**

Catalog PV-5 shows the full line of Powell steel and semi-steel lubricated plug valves, wrench and gear operated. The various types are illustrated in color, and available sizes, pressures, and complete dimensions are given. Accessories, lubricant recommendations, and maintenance suggestions included.

Wm. Powell Co.

**398—Gate Valves**

Through conduit and venturi ASA gate valves in sizes 2" through 30" and ASA series 300 lb through 900 lb are described in Catalog 300. The 64-page catalog includes complete dimensional data. Also outlined are the unique advantages of W-K-M's parallel expanding gate valves.

W-K-M division of ACF Industries, Inc.

**399—Steel Valves and Fittings**

Henry Vogt Machine Company has just released its new catalog of forged steel valves, fittings, flanges, and unions. Its 432 thumb indexed pages feature new types and trims to meet severe fluid and gas handling duties at all temperatures and pressures. A permanent book containing complete information.

Henry Vogt Machine Co.

**400—Farm Pool Drainage**

Catalog D-30160 tells in detail how an adequate water supply can be provided for all farm requirements through building a farm pond. Covered are planning, designing, and building. Tables, charts, and construction sketches included together with photographs of installations. Various products for farm ponds shown.

Armco Drainage & Metal Products, Inc.

**401—Snow Melting Systems**

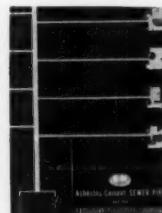
"Steel Pipe Snow Melting and Ice Removal Systems," 32 pages, presents the case for snow melting systems and shows typical installations in commercial and industrial locations. Design data is complete with information on anti-freeze mixtures, sizes, and spacing.

*Committee on Steel Pipe Research,
American Iron and Steel Institute.*

**402—High Pressure Valves**

Technical article on high pressure valves for high temperature duty. Describes design essentials, applications, typical designs, valve materials, special locking devices. Includes valve selection tables and installation and maintenance suggestions. Cutaways show operation and construction of valves and valve seats.

Yarnall-Waring Co.

**403—Gravity Sewer Pipe**

This new bulletin describes "K&M" asbestos-cement gravity sewer pipe with the exclusive, patented *Fluid-Tite Coupling*. Offers data on installation and operation plus information on infiltration tests, dimensions, and tolerances of pipe and couplings, and connections for joining pipe to building sewer pipe.

Keasbey & Mattison Co.

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DIRECTORY OF ADVERTISERS' LITERATURE

PIPING, VALVES & PLUMBING SUPPLIES continued



404—Disc Valves

Bulletin 574 describes how, through a special Kennedy process in valve disc construction, valve service life is extended considerably. Tells of proof of service through exacting tests. Calling eliminated and no repacking required in 25,000 full cycles. Available valves listed. Cutaway and types of valves shown.

Kennedy Valve Mfg. Co.



405—Plumbing Drainage Control

Manual 54-2 is a comprehensive engineering specification manual covering all types of floor and area drainage controls. Contains illustrated, alphabetical, and product number indexes for easy cross reference. Detailed photographs, drawings, dimensions, and specification information on all floor drainage controls.

Zurn Industries, Inc.



406—Bronze Valves

New circular shows 150, 200, 300-pound bronze valves that offer such advantages as: full flow with least pressure-drop and turbulence, 500 Brinell stainless steel seats and discs, long life, little maintenance. Can be furnished with indicator arm, collar, and V-port disc for accurate visual control.

Wm. Powell Co.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.



407—Electric-Welded Steel Tubing

This four-page brochure is printed in two colors and gives sizes, weights, and uses of Wheatland Electric-Welded Steel Tubing. Also checklist of ordering information. Covers hot- and cold-rolled mechanical tubing, pre-dipped and hot-dipped galvanized. Illustrated and printed on heavy durable stock.

Wheatland Tube Co.



408—Filtration Plant Valves

The only valves specifically made for water filtration plants are shown in bulletin W-18. Complete specifications are given for drain, backwash and rewash valves. Valves can be remotely operated by electricity, air, or water. Actual opening and closing power is supplied by the line pressure itself.

Golden Anderson Valve Specialty Co.



409—Motorized Valve Actuators

Bulletin 5911 describes a complete line motor driven, geared power transmitters that automatically operate all types of valves and other rotating mechanisms. Explains complete operation. Gives dimension drawings and charts and lists complementary equipment.

Helitork, Division of Earle Gear & Machine Co.



410—Tin-Lined Pipes, Fittings, Valves

Bulletin 139 describes Barnstead's complete line of tin-lined pipes, fittings, and valves. Combining the chemical protection of pure tin with the strength and durability of threaded pipe, this tin-lined equipment protects the purity of distilled water from the point of origin to the point of ultimate use.

Barnstead Still & Sterilizer Co.



411—Nonlubricated Plug Valves

Twelve-page catalog 581 GP contains specification of all sizes (1 to 4 in.) and pressures (1000 psi to 10,000 psi CWP) of Graham nonlubricated plug valves. Cutaway view shows construction details of this round port, full opening valve. Photographs of valves, parts lists, body and trim materials included.

Texsteam Corp.



412—Stainless Steel Fittings

This 22-page catalog explains how Speedline stainless steel fittings reduce piping costs by allowing the designer to take advantage of the new and more economical schedules 5 and 10 stainless steel pipe. A schematic drawing illustrates industrial applications.

Speedline Stainless Steel Fittings Div., Horace T. Potts Co.



413—Disc Liquid Filters

Bulletin 7C, 16 pages, illustrates and describes the full line of crenulated laminated disc liquid filters for removing small micron-size foreign solids from most liquids in one pass through at a rate of 1 gpm at 1 psi pressure drop to 1200 gpm at 3 psi pressure drop, of 35 ssu viscosity fluid.

William W Nugent & Co, Inc.



414—Cast Iron Pipe

Catalog of cast iron pipe, fittings, fire hydrants, water works gate valves. Specifications, dimensions, and weights of ball and spigot, mechanical joint, flanged pipe, and fittings covered. Mathews Modernized, Mathews Flanged Barrel, and R. D. Wood Swivel Joint fire hydrants described. Also Wood gate valves.

R. D. Wood Co.

PIPING, VALVES & PLUMBING SUPPLIES continued

**415—Vitrified Clay Pipe**

Bulletin PS-101 describes Kaul Clay Company's *Presto SEAL* vitrified clay pipe. Socket and spigot ends are factory-molded polyester, with a rubber gasket permanently imbedded in the socket end. When socket and spigot ends of pipe are joined, a perfect, permanent, flexible seal is made in seconds.

Kaul Clay Co.

**421—Gate Valves**

Bulletin W-8899 describes Mueller gate valves having the exclusive four-point wedging mechanism complying with AWWA specifications. In addition to gate valves, the bulletin also describes cut-in sleeves and valves, inserting valves, and tapping sleeves and valves. Line drawings illustrate installation.

Mueller Co.

**416—Valves**

Bulletin V-1 describes in condensed form the various types of valves manufactured by Schutte & Koerting. Outlined in detail are check valves, back pressure valves, reducing valves, butterfly valves, bypass valves, and instant-acting valves. Other S-K valves are listed. Line drawings show operation of various valves.

Schutte & Koerting Co.

**422—Butterfly Valves**

Bulletin 590X offers a valve for piping or equipment where positive, bubble-tight or drop-tight closure is needed at operating pressures to 150 psi. Occupies a small fraction of space needed for gate or globe valves. Manual or automatic control. No fouling and self-cleaning.

W. S. Rockwell Co.

**417—Fabricated Pipe Fittings**

Bulletin 525 illustrates standard and special fabricated fittings which help in planning piping and equipment layouts. Data includes specifications and prints on standard fittings for lightweight pipe. The bulletin also illustrates special fabrications designed to save time and labor.

Naylor Pipe Co.

**423—Eye/Face Wash Safety Fountains**

Specification sheet S-182 shows installation details and dimensional drawings for a new concept in eye/face wash design, Haws Model 7900. Six spray jets set up a feather-soft "field of water" to wash away contamination from injured eyes and facial areas. Extra-large stainless steel bowl for maximum coverage.

Haws Drinking Faucet Co.

**418—Entrainment Separators, Traps**

Bulletin 811 describes and illustrates new Wright-Austin designs of entrainment separators and traps used for steam, compressed air, and gas applications. Also contains selection-capacity charts and data on air vents and strainers. Features of construction are enumerated and emphasized.

Wright-Austin Co.

**424—Pipe Fittings**

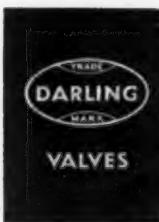
Catalog I presents the complete line of NIBCO wrot, cast solder, cast drainage, flanged, and flared tube fittings. It is a manual of technical information to help the consultant select fittings for copper tube installations. Included are rough-in measurements, advantages of using NIBCO fittings, engineering data.

NIBCO Inc.

**419—Steam Specialties**

Bulletin SS-140-C contains detailed data on Strong's extensive line of in-line steam traps, strainers, and pressure reducing valves. Applications, detailed specifications, list prices, and cutaway drawings are included, along with the wide range of fitting sizes, materials, and temperature and pressure capacities.

Strong, Carlisle & Hammond.

**425—Gate and Check Valves**

Catalog 57 describes Darling's line of gate valves and check valves in iron, bronze, steel, and special alloys for all types of valve application. Also included are fire hydrants and accessories for fire protection. This 244 page bound volume gives specifications; pictures facilities; and illustrates product applications.

Darling Valve & Manufacturing Co.

**420—Iron Pipe, Tubing, and Fittings**

Catalog L-127 describes the complete line of American ductile iron pipe, tubing, casings, fittings, and special castings. Includes valuable technical information; grades, specifications, dimensions, and weights. Typical applications include underground piping, industrial piping, well casing, and many others.

American Cast Iron Pipe Co.

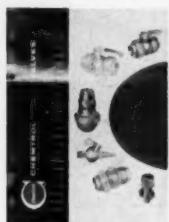
**426—Rubber Seat Butterfly Valves**

Bulletin 10J is a new catalog describing the new *Monoflange MARK II* rubber seat butterfly valve. The catalog has been designed to be the ideal working tool for engineers and users of this type equipment. Complete specifications, flow data, certified drawings, weights, freight rates, and prices are included.

Henry Pratt Co.

DIRECTORY OF ADVERTISERS' LITERATURE

PIPING, VALVES & PLUMBING SUPPLIES continued



427—Plastic Valves

Data Sheet 260 describes the complete line of Chemtrol plastic ball valves for use with acids, alkalies, and many solvents. Includes valve dimensions and chart showing correct type of plastic for specific operating temperatures and pressures. Cutaway of each valve shows construction and operation.

Chemtrol.



428—Glass-Lined Sewer Pipe

Folder deals with the glass-lined sewer pipe with a mechanical joint. *Amit Glas-Glaz* pipe is available in 4-ft lengths. It is root and infiltration proof and is glass lined inside and out. The pipe has been designed for an under-the-house drain and also as a house-to-street sewer.

American Vitrified Products Co.



429—Valve Comparison Chart

Bulletin 1012 is a OIC valve comparison chart, republished with up-to-date valve cross references. New features: breakdown on valve types by pressure class and design; federal specifications; valve trim cross reference chart; other valve manufacturers products cross referenced to OIC valves. Speeds up specifying.

Ohio Injector Co.



430—Packaged Pipelines

Bulletin 559 describes Southern Pipe's Lite-Wall packaged pipelines for the oil and gas industries. Gives five ways this pipe cuts costs. Explains Lite-Wall welding process. Specialized engineering, production facilities, coatings, warehousing, and delivery schedules are included. Specifications on 3½ to 14 in. diameters.

Southern Pipe Div., U. S. Industries, Inc.

PLANT SITES

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.



431—Industrial Opportunities

A colorful new presentation of Colorado's industrial opportunities. Included are booklets on manufacturing, power, raw materials and resources, transportation, markets and labor, Colorado living, industrial site locations, state highway map, and full color recreation booklet. Up-to-the-minute data in portfolio form.

Colorado Department of Development.

POWER EQUIPMENT & FUELS



432—Boiler Selection

Catalog AD 173, "How to Select a Boiler," offers valuable suggestions to the consulting engineer and the architect on just what to look for when selecting a boiler. For example: first costs vs operating costs, packaged boiler vs the built-up boiler, and boiler design standards. Completely illustrated.

Cleaver-Brooks Co.

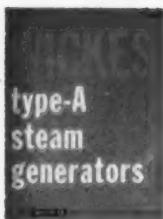


433—Burners

Form 5808 describes light oil, gas, and dual-fuel oil-gas burner designed for operation against firebox pressure. Fires number 2 fuel oil and/or natural or LP gas. Special burner head produces high combustion efficiency and prevents flame pulsation. Models available for firing pressurized or natural draft boilers.

Iron Fireman Manufacturing Co.

POWER EQUIPMENT & FUELS continued

**434—Steam Generators**

Wickes type-A steam generators, compact, efficient, shop assembled water tube boilers, are illustrated and described in catalog 56-1. It gives typical superheater arrangements for the boilers with section, plan, and side views of drainable "S", pendant, and drainable superheaters. Specifications are given.

Wickes Boiler Co.

**440—Automatic Boilers**

Bulletin BE-400 contains useful tabulated data on 35 models of Continental automatic "package" firetube boilers ranging from 15 through 600 hp sizes. Illustrated design specifications of the boiler itself and the integral burner and control system make the bulletin a helpful reference source for engineers.

Boiler Engineering & Supply Co., Inc.

**435—Vibra-Grate Stokers**

A water cooled vibrating grate stoker (sizes from 25,000 to 150,000 pounds of steam per hour) that does not require a dust collector and assures freedom from smoke, even at low ratings. Burns low grade coals with top efficiency and is easily adapted for burning gas or oil in combination with coal, or singly.

American Engineering Co.

**441—Engines**

Bulletin SA-612-B, a complete listing of all Climax engines and complete power unit ratings showing maximum hp available for bare engines and recommended operating ratings for various applications of power units with accessories. Complete bulletins describing all models shown in the Power Chart are available.

Climax Engine Manufacturing Co.

**436—Spreader Stokers**

New bulletin 860 illustrates and describes the Detroit RotoStoker, a spreader stoker with overthrow rotor feeders. For use with medium size boilers up to about 60,000 pounds of steam per hour capacity. Power dumping, hand dumping, or stationary grates. May be installed in almost any type boiler.

Detroit Stoker Co.

**442—Packaged Hot Water Boiler**

Type CC Superior packaged boilers designed for hot water operations and for capacities from 670,000 to 11,720,000 Btu/hr are described in this catalog. Burning gas, oil, or both, the Type CC is equipped with a venturi-action mixing tube which overcomes problems developing from improper boiler circulation.

Superior Combustion Industries, Inc.

**437—Steam Generators**

Bulletin GB-1 gives testimonial proof of the value-packed Amesteam Generator, packaged firetube boiler. Sizes available: 20 through 600 horsepower; 20 through 250 pounds design pressure. Lists well-known users with photographs of actual installations. Illustrated literature available upon request.

Ames Iron Works.

**443—Airfoil Fans**

Bulletin 179 describes Green's complete line of airfoil fans for forced and induced draft service. This line of fans features an extremely wide range of pressure-volume ratios at high efficiencies for all mechanical draft applications. Charts, tables, and application notes. Drawing shows wheel types.

Green Fuel Economizer Co., Inc.

**438—Commercial-Industrial Burners**

Bulletin 1255 describes fuel burning systems for heating, power, and process requirements. Air or air/steam atomizing burners and partial pre-mixing gas burners are described, burner arrangements illustrated. Fuel consumption ranges from 20 gph to 300 gph on oil and 3,000 cfm to 40,000 cfm on 1,000 Btu gas.

Orr & Sembower, Inc.

**444—Vented Deaerators**

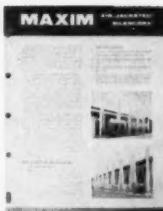
Bulletin 575-A explains continuous boiler feed water deaeration under .005 cc/liter without vent loss or adjustment, over a 10-to-1 load swing, without sodium sulphite. Illustrates operating principle and components. For boiler plants with capacities from 3,000 to 125,000 lbs./hour. Specifications are included.

Fred H. Schaub Engineering Co.

**439—Packaged Steam Generators**

Bulletin PG-58-2 describes automatic packaged boilers, oil or gas fired, available in capacities from 13,000 to 100,000 lb per hr with design pressures from 250 to 1350 psi. Cutaway wash drawing shows construction. Features, standard equipment, and optional equipment listed. Capacities and dimensions in charts.

Foster Wheeler Corp.

**445—Air-Jacketed Silencers**

Data Sheet D-192 describes Maxim air-jacketed silencers which not only suppress engine noise to desired levels, but also provide an economical means of ventilating engine rooms and surrounding areas. Line drawings show horizontal and vertical installations. Complete dimensional data on various models.

Emhart Mfg. Co., Maxim Div.

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DIRECTORY OF ADVERTISERS' LITERATURE

POWER EQUIPMENT & FUELS continued



446—Operating Spreader Stokers

Guide to efficient operation of single- and multiple-feeder spreader stokers supplements manufacturer's instructions. Covers pre-starting and operating procedure, fire cleaning, oiling, inspection, and taking equipment out of service. Relates symptoms and probable cause of operating problems to remedial action.

BCI Dept., National Coal Association.



447—Pressurized Steam Generators

Catalog SB59 describes the Erie City symmetrically designed Keystone 2-drum pressurized steam generator. Features integral water walls contained in welded steel casing backed up by block insulation and an outside bolted casing. This boiler is adaptable to a wide range of capacities. Illustrations and data.

Erie City Iron Works



448—Transfer Oil Heater

Bulletin 25A-1 describes the 100% automatic, no freezing, no corrosion operation of the Texsteam 25A transfer oil heater which provides temperatures to 600°F with low pressure vessels and flow circuits. Unit is gas or oil fired. Bulletin includes specifications and curve for sizing to specific applications.

Texsteam Corp.



449—Engines and Generator Sets

Complete 80-page catalog includes power curves, sectional drawings, and subassembly photographs of six basic engines in 19 models, a power range of 100 to 2150 bhp. Diesel, gas, and dual fuel engines and generator sets are available as a custom installation.

*White Diesel Engine Division,
White Motor Co.*



450—Aftercoolers

How aftercoolers remove moisture from compressed air and gas is explained in bulletin 130. Schematic flow diagrams show how aftercoolers can cool and dry compressed air systems in an plant. This eight-page, three-color bulletin is profusely illustrated. Full line of air engineering equipment shown on last page.

Niagara Blower Co.



451—Steam Generators

Bulletin PSG-3, 10 pages, presents design and construction details, tables of capacities, dimensions, and weights of package unit type steam generators. Available in three standard pressures of 175, 250, and 375 psig, the boilers are designed to be used with different types of firing and control equipment.

Henry Vogt Machine Co.



452—Forced-Draft Burners

Bulletin describes compact forced draft package unit burner. This single, coordinated, factory-tested assembly, ready for attachment to boiler, combines all necessary equipment for burning oil or gas fuels. Gives details of design and features. Diagrams are keyed to chart giving dimensions for all models.

S. T. Johnson Co.



453—Power Engines

Bulletin 4331 B1 describes Worthington's newest power engine. Turbocharged, medium sized, 440 to 1100 hp, the SLHP is ideal for municipal, industrial, sewage, and public works power requirements wherever gas is available for fuel. Bulletin furnishes cutaway sections, dimensions, and other important data.

Worthington Corp.



454—Heavy Duty Fans

New bulletin FD 905 covers the complete line of mechanical draft and other heavy duty fans. Information covers shafts, housings, inlet boxes, variable inlet vanes, dampers, bearings, shaft seals, blade and scroll liners. Applications discussed include forced and induced draft, primary air, cyclone compressors.

Buffalo Forge Co.



455—Burners

This new 16-page booklet illustrates and describes Ray Burner equipment for firing oil, gas, or combination oil or gas: manual, semiautomatic, and fully automatic models; rotary, pressure atomizing, inshot gas, packaged forced draft boiler-burner units. A burner for every domestic, commercial, or industrial need.

Ray Burner Co.



456—Packaged Boilers

A completely new line of low and high pressure forced draft water tube packaged boilers is described in bulletin 1400. Known as the Compak series, these factory-tested units are offered in 22 sizes ranging in capacity from 12 through 750 horsepower. Engineering specifications with catalog literature.

International Boiler Works Co.



457—Diesel Engines

Bulletin 40-20189 describes diesel engine power by Caterpillar. Includes specifications and illustrations of four-cycle diesels for any job, modern power plants with compact generators, and marine engines for continuous duty. Engines and attachments adaptable into engine packages for special needs.

Caterpillar Tractor Co., Engine Division.

POWER EQUIPMENT & FUELS continued

**458—Packaged Air Preheater**

The important points to consider in selecting a preheater for use with small boilers (25,000 to 250,000 lbs per hr) are discussed in four-page bulletin on the new package Ljungstrom air preheater. Explains how preheater saves fuel, increases boiler output and reliability, and permits use of lower grade fuels.

Air Preheater Corp.

**464—Wormfeed Stokers**

Bulletin 559 describes Canton's *Duraflex* wormfeed stokers for bituminous and anthracite coal. Included are specifications and ratings for bituminous coal, descriptive drawing showing assembly and method of feeding, components of the feeding assembly, model boiler room plan, and the many features of the stoker.

Canton Stoker Corp.

**459—Stationary Diesel Engines**

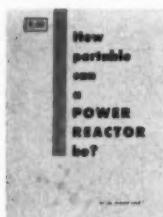
Bulletin 110 describes Models 60 and 80 *Superior* stationary diesels. Four-cycle, 6- or 8-cylinder, in-line models, ranging from 530 to 2000 bhp and from 300 to 1250 kw. Typical applications are water works, sewage plants, power plants, and others. Specifications given.

*White Diesel Engine Division
White Motor Co.*

**465—Deaerators**

Vertical and horizontal tray type deaerators for effective removal of corrosive gases from boiler feed water are the subject of booklet 28B8853. Principles of operation and important features are described. Technical data is presented in handy table form. Effluent capacities from 18,000 to 550,000 lb/hr.

Allis-Chalmers.

**460—Packaged Nuclear Power**

Booklet entitled "How Portable can a Power Reactor be?", written by John P. Tully, provides the answers to packaged nuclear power. Artist's conception shows Alco's packaged nuclear power plant installed. Line drawings show elevation and plan view of skid-mounted primary system package.

Alco Products, Inc.

**466—Packaged Boilers**

Western Boiler Company announces its new *Webco-Ray Husky* series packaged boilers. Sizes 20 to 125 hp. Models to burn all grades of fuel oil, natural gas, or combination gas/oil. All units completely automatic. Write for new catalog and the name of your nearest local distributor. Completely illustrated.

Western Boiler Co.

**461—Automatic Firing Equipment**

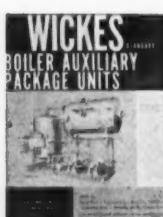
Catalog 6260 describes the complete line of Iron Fireman commercial and industrial burners. Included is an "Index and Selection Chart" which enables users to select appropriate equipment based on type of fuel desired and kind of draft. Single or dual-fuel combustion equipment available.

Iron Fireman Manufacturing Co.

**467—Shot Cleaning System**

Bulletin 2145 covers the new Diamond shot cleaning system for the most efficient and economical cleaning of such external horizontal tube surfaces as superheaters, reheat economizers, and air heaters. Gives advantages, principles, construction, and operation. Chart shows draft loss from ineffective cleaning.

Diamond Power Specialty Corp.

**462—Boiler Auxiliary Packaged Units**

Bulletin 59-1 describes auxiliary package units available for boilers of 10,000 to 100,000 lbs steam per hour, steam pressure to 300 psig. Units have various combinations of deaerating feedwater heaters, boiler feed pumps, condensate surge tanks to reduce maintenance and to increase plant efficiency.

Wickes Boiler Co.

**468—Diesel Engines**

Bulletin DE-6 describes Alco 251 diesels. Available in three sizes, Six, Vee 12, and Vee 16 and ratings from 550 to 2400 hp. Cutaway of Vee model shown together with illustrations and descriptions of components. Diagrams of In-line 6, Vee 12, and Vee 16 with dimensions and specifications.

Alco Products, Inc.

**463—Automatic Coal Firing Units**

A compact, automatic coal firing unit for installations of 175 hp to 350,000 pounds of steam per hour and upward. Engineered for top efficiency with both low and high ash coals. Exclusive conveyor feeder won't clog and provides even distribution throughout entire range, 50 to 7500 lbs coal per hr.

American Engineering Co.

**469—Induced Draft Bifurcator**

Bulletin DB-44-56 describes DeBothezat's induced draft bifurcator, which provides instant, adequate draft eliminating costly stacks. Construction features are listed and illustrated with cutaway. Installation photographs, boiler code ratings, selection data, dimensional drawings.

*DeBothezat Fans, Division of
American Machine & Metals, Inc.*

To order personal copies of these bulletins fill in the coupon on page 44.

POWER EQUIPMENT & FUELS continued

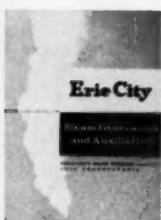
**470—Leasing Coal-Burning Equipment**

Compares costs of full and partial leasing of coal-burning equipment with outright purchase. Explains leasing procedure, legal aspects. Lists companies engaged in leasing, and tabulates comparisons of annual charges and operating costs of coal and oil-fired plants on equipment purchase and lease basis.

BCI Dept., National Coal Association.

**476—Municipal Engines**

Bulletin SA-631 describes the complete line of Climax engines built for municipal plant service. These engines, from six to twelve cylinders and from 60 to 600 hp, are available for all sewage and water treatment plant applications. Climax engines are noted for simple, rugged construction and smooth operation. *Climax Engine Manufacturing Co.*

**471—Two-Drum Steam Generators**

Catalog SB61 describes Erie's City single-pass and multi-pass 2-drum complete steam generators. Installation drawings of each type illustrate various combinations of Erie City auxiliaries. Steam separator, superheaters, economizers, air preheaters and water wall designs are described and illustrated.

Erie City Iron Works.

**477—Packaged Gas/Oil Burner**

Bulletin BE-300 describes exclusive mechanical pressure atomizing oil and nozzle mix gas burner with which Continental automatic "package" firetube boiler is equipped. Three full-page wash drawings describe construction features and principle of operation of the compatible oil and gas burners.

Boiler Engineering & Supply Co., Inc.

**472—Discharge-Silencers**

Data Sheet D-180 describes Maxim high-velocity discharge silencers to handle flows to atmosphere of steam, air, or gas from safety valves, gas turbines, and turbo-charged gas engines. Installation directions on three available models. Drawings show construction and are keyed to dimension tables. Applications. *Emhart Mfg. Co., Maxim Div.*

**478—Waste Heat Recovery**

Bulletin WHB 59-3 describes the economic utilization of excess heat developed from diesel exhaust gases and industrial and chemical processes. Specific industrial, marine, and chemical applications of varying capacities and services are illustrated. Advantages of bare tube and extended surface designs are noted.

Foster Wheeler Corp.

**473—Boiler Feed Systems**

New Catalog 55-D contains revised specification and application data on standard and special design boiler feed systems from Schaub Engineering Co. Pumps furnished with *Dura-Hard* electro-tized impellers for double service life. High pressure boiler feed systems include rugged power plant pump line. *Fred H. Schaub Engineering Co.*

**479—Complete Packaged Boilers**

Bulletin AA-1 announces the new compact Model AA *Amesteam* generator, a complete package boiler available in sizes ranging from 20 hp through 600 hp. Oil or gas fired. Each unit is completely equipped with all necessary boiler fittings, is guaranteed to operate at 80 percent thermal efficiency.

Ames Iron Works

**474—Low-Level Economizer**

Bulletin 178 describes a low-level economizer specifically designed for low-temperature heat recovery. Extended-surface cast iron type utilizes a separate water circuit. This circuit transfers the recovered heat into the incoming combustion air to help protect the air heater surface while increasing overall efficiency. *Green Fuel Economizer Co., Inc.*

**480—Oil and/or Gas Fired Boilers**

Bulletin 1260 describes and illustrates *Powermaster* Model 3 line. Includes gas, oil and combination gas-oil models, a new specially designed hot water boiler, and the new steam atomizing principle for use with No. 6 oil. Ratings and dimensions of all sizes in line are included. Cutaway shows operation. *Orr & Sembower, Inc.*

**475—Complete Packaged Boilers**

Twelve-page catalog describes Type AS Superior packaged boilers for capacities from 4000 to 21,000 lbs steam per hr. Complete packages with rotary burners, integrated controls, soot blowers, refractory, and insulation, these units also have quiet rear mounted draft fan which provides air-cooling of furnace floor.

Superior Combustion Industries, Inc.

**481—Refuse Burners**

Catalog 510 describes various methods of burning dry or wet bark, scrap wood, corn cobs, bagasse, spent coffee grounds, and other types of refuse on Detroit RotoStokers and RotoGrate Stokers. Refuse is burned separately or in combination with coal using automatic feeder systems. *Detroit Stoker Co.*

POWER EQUIPMENT & FUELS continued

**482—Packaged Boilers**

Bulletin AO 184, describes the CBH packaged boiler. Tailored for heating and processing loads in 25 through 100 hp range. Four-pass, forced draft design, light oil, gas or combination oil/gas fired. Cutaway shows design, construction, and operation. Line drawings show burner operation and water circulation.

Cleaver-Brooks Co.

**483—Rotary Burners**

Bulletin describes Johnson Model 53 fully automatic, metering pump rotary burners. This burner insures smooth automatic starts even after lengthy shut downs. Will fire on oil only, gas only or combination oil and gas. Available in 9 sizes from 28 hp to 560 hp. Detailed dimensions given.

S. T. Johnson Co.

PUMPS & COMPRESSORS**484—Power Plant Pumps**

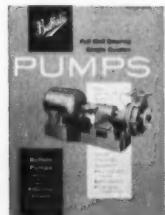
Bulletin C107 gives everything needed by the engineer in his selection of power plant pump requirements up to 100 gpm and 800 ft tdh. Included in this 44 page bulletin is speed conversion ratios, performance curves, the NPSH formulae, and mechanical loading limits on two-stage turbine power plant pumps.

Roy E. Roth Co.

**488—Industrial Pumps**

Catalog describes uses and construction of new FloWay line of industrial pumps manufactured by Fiese & Firstenberger. Capacity range is from 15 to 4000 gpm. FloWay vertical turbine pumps are designed for every industrial and municipal pumping need and for every pumping condition.

Fiese & Firstenberger Mfg., Inc.

**485—Close-Coupled Pumps**

New bulletin 975-F gives complete information relative to mechanical and hydraulic features of close-coupled pumps. Suitable for most pumping situations and especially desirable in limited space. Parts interchangeability permit low inventory. Application data included in bulletin. Rating tables simplify selection.

Buffalo Forge Co.

**489—Submersible Water Pumps**

Bulletin 202 describes Layne submersible pumps giving detailed cross section drawings and illustrations of municipal and industrial applications including plant water systems, irrigation, reservoir pumping, municipal primary water supply. Pump diameters of 4" and up for capacities as required.

Layne & Bowler, Inc.

**486—General Service Pumps**

Bulletin 100 gives complete data on the Weinman Type AC general service Unipump for pressure boosting service, hot and chilled water circulation, and other general pumping requirements. Bulletin includes drawings, dimensions, performance chart, and pump selection table for the many available models.

Weinman Pump Manufacturing Co.

**490—Rotary Blowers and Pumps**

Listing 18 standard sizes of both air blowers and gas pumps of rotary positive displacement type, combined Bulletin AF-XA-360 covers capacity ranges to 900 cfm in each. Complete performance rating tables and dimension information provided. Blowers rated 10 psig or 12" hg vacuum, pumps 6 psig. Roots-Connersville Blower Division.

**487—Industrial Pumps**

Bulletin describes Byron Jackson's complete line of centrifugal pumps designed for every industrial pumping requirement. Actual installations of all major types of centrifugal pumps are shown. Included are general capacity ranges and conditions.

Byron Jackson Pumps, Inc.
Subsidiary of Borg-Warner Corp.

**491—Mixed-Flow Pumps**

Bulletin describes a new line of large volume pumps for medium lifts from 20 to 80 feet, with capacities that exceed 100,000 gpm. Engineered for industrial, agricultural, and municipal use. Bulletin contains construction details for both pump and systems, cutaway, specifications, material tables, and other data. Johnston Pump Co.

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DIRECTORY OF ADVERTISERS' LITERATURE

PUMPS & COMPRESSORS continued



492—Submersible Water Pumps

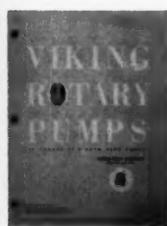
Bulletin BI300 describes Sumo's industrial size submersible water pumps from 3 through 125 hp at 3550 and 1750 rpm. Heavy duty pumps used for municipal water supply and booster systems, industrial and commercial buildings, institutions, and irrigation. Features are pointed out in cutaway photograph.

Sumo Pumps, Inc.



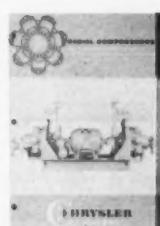
498—Pumps and Blowers

California series rotary positive blowers, gas pumps, and vacuum pumps are described in bulletin S-59G with dimension drawings and capacity tables. For volumes up to 2480 cfm single stage with pressures to 10 psi or vacuums to 20 in. Hg. Features anti-friction bearings, wide-face timing gears, oil-free. *Sutorbilt Corp.*



493—Rotary Pumps

Catalog 60-S includes illustrations and specifications on general purpose and heavy-duty Viking rotary pumps. Also includes data on many special rotary pump units. A complete list of district offices and distributors reveals where additional information may be obtained promptly. All models are illustrated. *Viking Pump Co.*



499—Radial Compressors

Catalog ME 120 describes radial compressors for commercial and industrial air conditioning and refrigeration. Contains exclusive features, capacity ratings, schematics, condenser data, and rough-in dimensions. Cutaway shows construction and component parts. Engineering specifications are given. *Chrysler Corp., Airtemp Division.*



494—Centrifugal Compressors

Bulletin 16 B 6048 C describes single-stage centrifugal compressors manufactured by Allis-Chalmers. Cutaways show component parts of each style compressor. Includes drawings and specifications on bearing arrangements, shaft seal arrangements, and impellers. Performance data includes graphs. Illustrated. *Allis-Chalmers.*



500—Grout Pumps

Bulletin WS-150 contains data and specifications on grout pumps, the only Simplex type for grout, slush, mud, and other heavy viscosity liquids. Pumps feature simplified heavy-duty design and can use air, steam, gasoline, diesel, electric motor or turbine drives.

*Wagener Pump Div.,
Canton Stoker Corp.*



495—Manual of Pumping Problems

"How to Solve Pumping Problems," 36-page instruction manual, covers important fundamentals of estimating requirements of the average pumping job. It contains sample problems on hydraulic systems, general transfer, and pressure transfer, plus tables, charts, and other pertinent engineering data. *Roper Hydraulics, Inc.*



501—Jet Pumps

Bulletin 512R describes jet pumps that will perform a wide variety of pumping operations. The principle of jet pump operation is explained in detail. Line drawings show pump design. Capacity charts and specifications are given for various models. Schematics show typical arrangements and applications. Special pumps. *Penberthy Mfg. Co.*



496—Gear Pumps

An economical gear pump, the Hydrex, for heavy-duty use on a wide range of pumping jobs, is described in eight-page bulletin H-2. It shows the simplified design, advantages, uses, sizes, and capacity of units with discharge to 350 gpm, for pressures to 500 psi, and fluid viscosities from 32 SSU to 250,000 SSU. *Sier-Bath Gear & Pump Co., Inc.*



502—Air Compressors

Bulletin GO-259 on new line of air compressors constructed with carbon-graphite piston rings and skirts. Air is completely oil free because there is no oil in the air compressor. Models are available portable, tank-mounted and as tankless models. Capacities are $\frac{1}{4}$ hp to $\frac{1}{2}$ hp. Pressures to 190 lbs. Specifications. *Bell & Gossett Co.*



497—Cyclone Separator, Aftercooler

Bulletin 714 describes in detail the advantages and the use of the R. P. Adams cyclone separators and pipe line aftercoolers in maintaining clean, dry compressed air supplies. It is complete with engineering tables, color diagrams, and installation photographs which dramatically illustrate advantages. *R. P. Adams Co., Inc.*



503—Chemical Solution Pumps

Bulletin 2-340 describes Bruner's chemical solution pump. Model 17 complete package includes power drive, electric cord, plastic tubing, foot valve, automatic injection nozzle control, and instruction manual. Diagrams show operation for different uses. Features of pump are listed with various accessories. *Bruner Corp.*

PUMPS & COMPRESSORS continued

**504—Heavy Duty Metering Pumps**

Catalog 420.200, illustrated, describes new Series 200 pump line, with range from 0.65 to 2025 gals/hr. Each unit has 1, 2, or 3 liquid ends, and several units can be driven by one motor. Stroke speed is changed on one model while running, on another while shut down. Catalog gives description and technical data.

Wallace & Tiernan Inc.

**510—Rotary Positive Blowers**

Series 400 and 600 rotary positive blowers, gas pumps, and vacuum pumps are described in bulletin S-65C, including dimension drawings and cutaways. Volumes up to 20,000 cfm single stage with pressures to 10 psi or vacuums to 20 in Hg. Features anti-friction bearings and wide-face herringbone timing gears.

Sutorbilt Corp.

**505—Vertical Turbine Pumps**

Bulletin 11 describes Watermaster vertical turbine pumps. These pumps have the same precision engineering and high qualities that characterize high capacity pumps by Fiese & Firstenberger. They cover a wide range of uses where the need is for relatively small capacities, from 15 gpm to 125 gpm.

Fiese & Firstenberger Mfg., Inc.

**511—Submersible Pumps**

Bulletin B-259 describes the new design of the Super-Sumo submersible pump for 4" and larger wells. Designed for economy installations, the pump features bronze and stainless steel construction for corrosion resistance, long life, and maximum pumping capacity. Sizes from 1/3 hp to 1½ hp, capacities to 1700 gph. Sumo Pumps, Inc.

**506—Small Rotary Vacuum Blowers**

A new line of heavy duty, vertical type vacuum blowers, designed for the smaller volume applications requiring vacuums to 20" hg, are described in specification bulletin S-RVS-159. Capacity and horsepower ratings for 10 blower sizes are included, ranging from 32 to 2360 cfm, also construction and dimension data.

Roots-Conversville Blower Division.

**512—Propeller Pumps**

Bulletin 1024A describes the improved line of large volume propeller pumps designed for all heavy duty uses. For low lifts from 2 to 40 feet with capacities from 500 to 100,000 gpm. Bulletin contains construction details, cutaway of pump with callouts, dimensions with line drawings, specifications, other data. Johnston Pump Co.

**507—Multi-Stage Centrifugal Pumps**

Bulletin 1300 describes Weinman Type JC multi-stage, split case centrifugal pumps. Available in three models designed for direct connection to motors, steam turbines, or engines. Bulletin gives complete information on pump construction, dimensions, and specifications. Dimensional drawings and sectional views. Weinman Pump Manufacturing Co.

**513—Pumps for Nuclear Fluids**

Bulletin BJPE-59-324 shows nuclear pumping requirements of various installations, and describes how BJ Pumps were designed to meet them. All basic types, liquid metal, liner-motor, and mechanically-sealed pumps are covered. Special techniques are shown.

Byron Jackson Pumps, Inc.
Subsidiary of Borg-Warner Corp.

**508—Pumps and General Services**

Bulletin 100, condensed list of services pertaining to water well systems, pumps, drilling, allied services, and equipment. Includes water wells, oil and water lubricated vertical turbine pumps, well screens, special pumps for many uses, irrigation, special drilling, water treatment, and service work.

Layne & Bowler, Inc.

**514—Single Suction Pumps**

New bulletin 976-G gives complete specifications on full ball bearing single suction pumps. Use includes handling saturated refrigerants and saturated liquids in air conditioning, viscous fluids in petrochemical and process industries, corrosive liquids, general water supply, and many others.

Buffalo Forge Co.

**509—Motor-Mounted Pumps**

Bulletin SP-509 describes the new line of small motor-mounted Viking pumps available in ½, 1½ and 3 gpm sizes integrally mounted with 1750 rpm motors. Pumps are suitable for handling liquids up to 7500 ssu and up to 500 psi handling lubricating oils and fuel oils above 100 ssu. Specifications. Viking Pump Co.

**515—Power Plant Pumps**

Bulletin 107A gives complete technical data on two-stage turbine power plant pumps. Includes details of construction, installation dimensions, range, applications, optional mechanical seals, and NPSH ratings. Also includes selection tables on pumps of capacities ranging from 5 gpm to 100 gpm, 100 to 800 ft tdh. Roy E. Roth Co.

STRUCTURAL MATERIALS & EQUIPMENT**516—Slag for Road Construction**

Bulletin ADUCO-80-80011 is a reprint of a two-page article discussing the various uses of both air-cooled and granulated blast furnace slag in paving several roads with bituminous concrete. Cross section of typical flexible bituminous concrete pavements shown. Photographs of actual paving operations. *U. S. Steel Corp.*

**522—Plaster Aggregate**

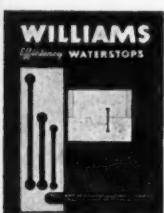
Bulletin P12 contains complete plastering specifications and fireproofing data for Permalite Perlite plaster aggregate, used as lightweight fireproofing on ceilings, walls and partitions, columns, and beams. Characteristics, advantages, mixing, and application instructions included. Contains charts of typical fire ratings. *Great Lakes Carbon Corp.*

**517—Rolling Counter Shutters**

Bulletin 103 describes the Kinnear rolling counter shutters with midget slats. These metal shutters afford protection against weather, pilfering, or illegal entry. End photographs show construction of slats. Diagrams show dimensions for both crank and push-up operation. Includes specifications and special features. *Kinnear Manufacturing Co.*

**523—Utility Deck**

Catalog U-601, January, 1960, illustrates and describes a multi-purpose, light gage, galvanized steel deck. Engineered specifically for short span construction and rigid insulation board. Provides fast, low-cost year-round construction. Catalog includes features, photographs, properties, and load tables. *Granco Steel Products Co.*

**518—Waterstops**

Four-page bulletin WS-59 covering complete line of rubber, vinyl, and neoprene waterstops with molded accessories such as unions, ells, tees, and crosses — both flat and vertical. Includes properties and characteristics, recommendations for use, methods of installing in formwork, and suggested specifications. *Williams Equipment & Supply Co.*

**524—Steel Concrete Forms**

Catalog 245 describes Inland Ribform, a permanent steel form for concrete floor and roof slabs. Ribform is fabricated from high tensile steel in lengths to meet specifications. Erection is quick and easy. Available in standard, heavy-duty, and super-duty weights; black (uncoated) and galvanized steel finishes. *Inland Steel Products Co.*

**519—Cellular Steel Floor Wiring**

Bulletin C-7099 contains complete information on the General Electric Cellular steel floor wiring system. Complete description, photographs, and dimensional drawings of all components are included. Contains layout design information, suggested specifications, application data, and installation instructions. *General Electric Co.*

**525—Concrete Curing Compounds**

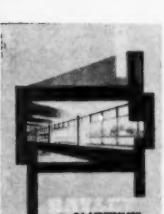
Bulletin 1415 describes Horncure concrete curing compounds. Includes application methods of 30D and C, 100% resin base curing compound; 40W, white pigmented curing compound; 50D and C, wax-resin base curing compound; and 60D and C, wax-resin curing compound. Advantages of Horncure are listed. *A. C. Horn Cos., Div. Sun Chemical Corp.*

**520—Reinforced Plastic Panels**

Bulletin 1717RSF describes Stylux, the reinforced plastic panel, manufactured by Butler. Panels are used for commercial and industrial skylighting, window glazing, and ornamentation. Information especially for the use of consulting engineers includes specifications, product data, and installation details. *Butler Manufacturing Co.*

**526—Rubber Control Joints**

Four-page bulletin describes Rapid wide flange and Rapid regular rubber control joints for use in masonry walls. Included are features, advantages, physical properties, general specifications. Line drawings show both types with dimensions, also method of application are included in this bulletin. *Dur-O-wal.*

**521—All Types of Aluminum Windows**

Catalog A-60 describes the complete line of Bayley aluminum windows, including original Bayley features. The booklet includes such items as projected windows, pivoted windows, class room windows, ribbon windows, and detention windows. Dimensions, construction, design, fasteners, materials, and finish. *William Bayley Co.*

**527—Wire Rope Catalog**

A complete basic catalog for selecting wire rope for any use. Cross sections of different types of rope show construction. Rope diameters, breaking strength, and weight are given for all classifications. Well illustrated showing different uses. Wire rope fittings are illustrated. *American Steel & Wire Division, United States Steel Corp.*

STRUCTURAL MATERIALS & EQUIPMENT continued

**528—Food Plant Floors**

Bulletin 3-2 describes Atlas *Furnace* food plant floors. *Furnace* construction speeds and simplifies the installation of a sound and attractive floor and used with either brick or tile construction. Typical installations are pictured. Line drawing shows construction. Photographs show installation techniques.

Atlas Mineral Products Co.

**529—Expanded Metal Partitions**

New catalog describes Globe *Safe-Guard* expanded metal partitioning with exclusive *Quick-Erect* patented fittings for easy method of guarding conveyors and machines and for all in-plant partitions. Catalog shows method of erection of prefabricated panels, full range of sizes available, and complete engineering data.

Globe Co.

**530—Construction Products**

Bulletin ADUCO-25638 deals in condensed form with sheet piling, bearing piling, concrete reinforcing bars, galvanized steel sheets, culvert sheets, and arch culverts. Uses and features included. Photographs show applications of various products. Diagrams, dimensions, and specifications.

U. S. Steel Corp.

**531—Tubular Railings**

A new bulletin on tubular railings has been prepared by Tubular Products, Inc. and is now ready for distribution. These are fitted and welded railings for industrial and commercial applications. They are ornamental and provide many safety features. Bulletin contains style drawings, photographs, and specifications.

Tubular Products, Inc.

**532—Acid-Proof Concrete**

Data Sheets are ready on Sauereisen *Pour-Lay* cement, the acid-proof concrete, for floors, tanks, and chimneys. Provides resistance to all corrosive acids, except hydrofluoric acid, and temperatures as high as 2000°F. Can be gunited, poured, cast in forms, or applied as a topping over concrete, brick, or tile.

Sauereisen Cements Co.

**533—Masonry Reinforcements**

The all new Sweet's brochure now available. AA Wire Products Company, manufacturers of masonry reinforcement and masonry ties, announce that the all new Sweet's brochure is now available. The new brochure features design drawings, photographs of installations, and suggested guide specifications.

AA Wire Products Co.

**534—Steel Deck**

Catalog D-60 covering four steel deck sections, produced in a 24 in. and 12 in. module. Includes description, section property tables and load tables in bending and deflection, specifications, construction details, and other information on steel deck used as curtain walls, partitions, and permanent floor forms.

R. C. Mahon Co.

**535—Metal and Wood Doors**

Bulletin DHSV-60 describes the D & H *Decor-Dor* line of flush-designed vinyl-on-steel, aluminum, and wood doors. Natural color illustrations show color and vinyl texture. Outstanding features of all three types, construction, sizes, and types of doors included. Wood doors have *PyroDor* structural mineral cores.

Dusing & Hunt, Inc.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.

**536—"Pozzolith" Concrete**

Bulletin P-36B discusses *Pozzolith*, the admixture for concrete. Points out how the use of this ingredient increases strength, bond strength, workability, durability; reduces shrinkage, permeability. It is recognized as an air-entraining agent, makes concrete resistant to scaling, and provides retarding action.

Master Builders Co.

**537—Shear Connectors**

Design Data describes the design and benefits of Nelson stud shear connectors for composite design of bridges and buildings. Types of shear connectors shown in line drawings. Bulletin includes installation photographs, tables, illustrative examples, and specifications.

*Nelson Stud Welding Division
Gregory Industries, Inc.*

**538—Structural Bolts**

Catalog describes Lamson high strength bolts for buildings, bridges, towers, and other applications, that give maximum holding power. Bolting principles, ordering data, prices are included. Bolt is distributed by 20 U. S. Steel Supply Division Steel Service Centers in key locations throughout the country.

Lamson & Sessions Co.

To order personal copies of these bulletins

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STRUCTURAL MATERIALS & EQUIPMENT continued



539—High-Strength, Low-Alloy Steel

Bulletin ADUCO-02018 discusses general properties, mechanical and performance characteristics, and economic advantages of USS Cor-Ten high strength steel. The booklet is profusely illustrated showing many applications of USS Cor-Ten steel in a variety of industries. Various operations in fabrication shown.

U. S. Steel Corp.



540—Service Fittings

Bulletin 493 illustrates design features, simplicity of assembly of new Spang service fittings, suitable for use with underfloor distribution systems of any manufacturer. Covers individual power and phone fittings and includes illustrations of linoleum pan, terrazzo holder, plus part numbers, and ordering information.

National Supply Co.



541—Steel and Aluminum Grating

This 16-page catalog shows the three basic types of grating construction; gives more than 30 dimensional drawings of subtypes; eight safe load tables covering steel and aluminum grating, roadway grating, and sidewalk slabs; tables on panel widths, tread widths, and floor armor. Planning layouts are given.

Borden Metal Products Co.



542—Off-the-Floor Fixture Supports

Manual 60 describes in complete detail pertinent engineering data required for proper specification of off-the-floor fixture supports. Minimum space requirements, dimensions, special variations, installation layouts, and mechanical features included. Covers supports for all type fixtures of all manufacturers.

Zurn Industries, Inc.



543—Expansion Plates and Bushings

Manual 55 contains complete information, technical data, and specifications about self-lubricating expansion plates and bushings for bridges, buildings, refinery equipment, chemical processing equipment, high temperature, missile and atomic energy applications. Fully illustrated with photographs and diagrams.

Merriman Bros., Inc., Lubrite Division.



544—Trackless Turnover Doors

Bulletin BB-160 describes the new *Byrn-over* door manufactured by Byrne Doors, Inc. This is a trackless turnover door that opens and closes twice as fast as other industrial doors. Requires minimum head and jamb clearance, has positive safety features, and provides cost advantages. All specifications listed.

Byrne Doors, Inc.



545—Protective Treatments

Sonneborn outlines uses and costs for 37 different "Building Saver" products. It covers treatments for concrete and wood floors, as well as admixtures for concrete and mortar, and waterproofing and damp-proofing compounds. There is quick-reading information on use and method of application.

Sonneborn Chemical & Refining Corp.



546—Doors for Special Services

Catalog describes horizontally hinged spring-assisted access doors. Complete line includes roof scuttles, smoke hatches, ceiling access doors, flush floor doors, sidewalk doors, basement doors. Specification outlines materials, prices, and weights. Line drawings show operation. Sales offices listed.

BILCO Co.



547—Chord Steel Joists

New 52-page bulletin contains complete data on Laclede straight chord steel joists, "S" and "L" Series. The bulletin includes numerous photographs, drawings and charts, plus such detailed information as design and construction features, dimensions and specifications, load and spacing tables, installation data.

Laclede Steel Co.



548—Aluminum Grating

Bulletin KA-160 describes a new kind of aluminum grating. New process permanently locks bars. No rivets, bolts, or screws. Contains illustrations and complete engineering data on grating and treads. Includes table of safe loads, weights and types, and panel width in inches. Three types of tread nosing.

Kerrigan Iron Works Co.



549—Processed Blast Furnace Slag

Bulletin ADUCO-80-80001 is a revised blast furnace slag insert prepared by the National Slag Association for inclusion in the current edition of Sweet's Catalog. Discussed are three types of slag; air-cooled, expanded, and granulated. Illustrated with graphs and photographs. Available publications listed.

U. S. Steel Corp.



550—Glass-Protected Smokestacks

Bulletin SS-202A describes *Permaglas* smokestacks, protected against corrosive flue gases. Features include longer life, low maintenance, lightweight, and easy installation. Chart shows how *Permaglas* stacks cost less over a period of years. Special *Permaglas* sections, smokestack accessories, and typical installations.

A. O. Smith Corp.

STRUCTURAL MATERIALS & EQUIPMENT continued

**551—Steel Stair Treads**

Tread-Grip steel stair treads combine strength of construction with safe, non-slip footing, according to four-page bulletin HTP2130. This brochure describes such features as A. W. Algrip nosing, electroforged and welded construction, and twisted cross bars. Included are detail drawings and dimensions.

Horace T. Potts Co.

**552—Galvanized Roofing and Siding**

Bulletin ADUCO-30305 describes 1½ in. and 2½ in. corrugated, 5-V crimp and *Stormseal* galvanized steel sheets. Advantages are listed. Roofing accessories pictured and described. Section on installation procedures together with 14 application tips. Method of computing and table of weights included.

U. S. Steel Corp.

**553—Building Wire**

Bulletin RCP-3001 describes Syntholin 901 building wire for hazardous industrial locations, such as found in oil refineries, industrial plants, and chemical plants. Physical and electrical characteristics are given. Detailed coverage on Type T or TW - 600 volt building wire. Specifications and illustrations.

Rome Cable Division of Alcoa.

**554—Precast Concrete Elements**

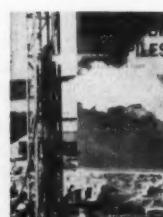
Catalog HMM 2180 graphically describes the unusual custom design possibilities of Marietta's complete line of precast and prestressed concrete building elements. The catalog gives complete information on the wide application for large or small all-concrete industrial and commercial buildings.

American-Marietta Co.

**555—Metal Gratings and Treads**

Bulletin 1110 was designed to help the engineer when specifying grating and treads. Welded grating available in steel and steel alloys and pressure-locked grating can be had in aluminum, brass, bronze, and stainless steel. Photographs and drawings show details of construction. Complete specifications included.

Dravo Corp.

**556—Fluted Steel Foundation Piles**

Catalog No. 91, 24 pages, contains information on physical properties and design features, standard weights and volumes of Monotube fluted, steel foundation piles. Included are photos of typical installations, test driving data, and other technical data of particular interest to consulting engineers.

Union Metal Manufacturing Co.

**557—Steel Rope**

This publication contains information required for selection and preparation of specifications for wire, strand, and rope used on guyed structures and suspended systems of all kinds, except major suspension bridges. Both standard and special fittings for use with bridge strand and bridge rope are illustrated.

John A. Roebling's Sons Corp.

**558—Pressure Grouting Services**

Bulletin PGS-0002 describes Halliburton Pressure Grouting Services including equipment, personnel, and materials for any size grouting job, a dependable and convenient method of metering, mixing, and placing grouting materials continuously. Selection of special chemical grouting fluids and cement grout slurries.

Halliburton Oil Well Cementing Co.

**559—Welded Steel Grating**

New eight-page illustrated bulletin describes Gary welded steel grating and treads. Has easy-to-use table of safe loads, weights and symbols, and panel widths. Included is data on fastening devices illustrated by drawings. Information on specifying grating and treads.

Rockwell-Standard Corp., Grating Division.

**560—Flooring, Grating, and Treads**

General grating catalog F-400 contains illustrations, descriptions, and complete engineering data on grating flooring, treads, and floor armoring (riveted, press-locked, and welded types). Irving grating is safe, durable, fireproof, ventilating, clean, and economical for industrial and power plant flooring and stairways.

Irving Subway Grating Co., Inc.

**561—Steel Buildings**

Catalog B-2059 describes the new line of Armco steel buildings. Four basic types provide clear span widths ranging from a few feet to 120 feet. Many features include special durable metals. Catalog provides complete engineering data and specifications. Commercial and industrial installations in full color.

Armco Drainage & Metal Products, Inc.

**562—Stainless Steel Walls, Roofs**

Bulletin ADUCO-03-19014 contains a comprehensive discussion of the many advantages of stainless steel walls and roofs for industrial and semi-industrial buildings. Pertinent data section includes corrosion resistance, characteristics, grades, thickness, and forms and finishes. Comparative erection costs.

U. S. Steel Corp.

To order personal copies of these bulletins

STRUCTURAL MATERIALS & EQUIPMENT continued

**563—Rolling Doors**

Bulletin 104, 36 pages, is a complete catalog of the many types of doors made by Kinnear. It gives information on the types of operations, both manual and electrical; elevation drawings; mounting methods for various applications and locations; specifications; and explains special construction features of these doors.

Kinnear Manufacturing Co.

**568—Factory Built Steel Buildings**

Bulletin ADUCO 30001 pictorially presents the various types of factory built steel buildings utilizing USS steels: galvanized roofing and siding, building frames from structural and plate steels, angles and bars, high strength steels. Advantages of steel building described and types of steel buildings diagrammed.

U. S. Steel Corp.

**564—Seals and Gaskets**

Four-page bulletin SG-659 covering complete line of Weathertite seals for various types of control joints in block constructed walls. It also covers masonry gaskets of nonabsorbent elastomer for use between sill and coping stones, brick or stone wall panels, and masonry and structural steel members.

Williams Equipment & Supply Co.

**569—Monopanl Walls**

Bulletin 1728 is a data and specification form outlining, for the consulting engineer, product information and specifications on a new self-sealing insulated wall panel with no visible joints. Butler's new *Monopanl* forms a complete wall, inside and out, factory cut to fit a pre-engineered structural system. Details pictured.

Butler Manufacturing Co.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.

**565—Steel Underfloor Duct Systems**

Bulletin C-7089 describes General Electric's three steel underfloor wiring systems. Complete product information, layout design data, and suggested specifications can be found on G-E's single-level, standard duct, single-level big duct, and two-level duct systems. Photographs, and application data.

General Electric Co.

**570—Curtain Wall Systems**

Catalog C-60 outlines Bayley aluminum or steel curtain wall systems and insulated panels with Bayley aluminum projected windows. Advantages of Bayley curtain walls include choice of distinctive wall treatment without cost of special design, a wall engineered to accommodate a building's movement.

William Bayley Co.

**571—Flooring Panels**

Catalog 270 describes *Celluflex*, the new panel which serves as both structural sub-floor and cellular raceway for in-floor electrification, communication, or heating systems. Includes load tables, section properties, construction and installation details, and specifications. Typical applications pictured.

Inland Steel Products Co.

**566—Concrete Slab Reinforcement**

Catalog BC-602 gives complete information on a reinforced concrete floor system with built-in underfloor electrification. Described in detail is Standard *Cofar* (without electrification) and E/R *Cofar* (with complete electrification.) Includes advantages, properties, fire tests, and specifications.

Granco Steel Products Co.

**572—Colorful Concrete Floors**

Bulletin 9641 describes *Colorundum* for colorful, durable concrete floors. Bulletin explains what *Colorundum* is, its uses and application by topping and monolithic methods. *Colorundum* companion products, *Colorundum* sealer and concentrated colorglaze wax, are described. Chart of 11 colors also available.

A. C. Horn Cos., Div. Sun Chemical Corp.

**567—Insulating Concrete**

Bulletin C12 contains complete specifications, mixing, and application instructions for Permalite Perlite insulating concrete. Roof deck and floor fill applications are illustrated and discussed. Engineering data, including safe uniform loads, and physical properties on roof deck systems, are included.

Great Lakes Carbon Corp.

**573—Masonry Wall Reinforcement**

This four-page bulletin is printed in two colors and describes Dur-O-wal masonry wall reinforcements. Included are features, advantages, physical properties, and general specifications. Information on cavity wall construction, rod deformation, bonding, and report of tests are also contained in this bulletin.

Dur-O-wal.

STRUCTURAL MATERIALS & EQUIPMENT continued

**574—Slag-Waste to Useful Material**

Bulletin ADUCO-80-80004 is the reprint of a feature article in the April, 1958 issue of the U. S. Steel News. This article tells how blast furnace slag, once nothing more than a waste by-product of steelmaking, is becoming an increasingly valuable and useful material for the construction industry. Illustrated.

U. S. Steel Corp.

**575—Cable, Wiring, Tubing Supports**

Two systems of support for all types of cable, wiring, and tubing are described in a 28-page illustrated catalog. Systems are engineered to be used interchangeably, depending on the weight of the load to be supported at any location. *Globetray*, the ladder-type tray, and cable-strut, the basket type, described.

Globe Co.

**576—Rezklad Flooring Compound**

Bulletin 3-4 describes *Rezklad* flooring compound for both new construction and the up-grading of existing floors. One-layer, corrosion-proof flooring system designed specifically for application to horizontal concrete surfaces. Features are listed and illustrated. Includes corrosion resistance charts.

Atlas Mineral Products Co.

**577—Fire-Resistant Columns**

Catalog covers the new concrete filled, double shell, fire resistant columns as manufactured by Tubular and approved by Underwriters' Laboratories, Inc. Specifications and cross-section sketches are provided for round, square, and rectangular tube columns. Contains comprehensive design details and sample computations.

Tubular Products, Inc.

**578—Wire Reinforcement Study**

New studies conducted by an independent research foundation agree with previous reports that the replacement of header courses by wire reinforcement *correctly designed* does not reduce the transverse strength of a wall. In fact there is an increase in strength of about 12 percent. Illustrations of use.

AA Wire Products Co.

**579—Industrial Cements**

New Data Sheets are now available from the Sauereisen Cements Company of Pittsburgh. These sheets describe their complete line of technical and industrial cements. Included in these informative data sheets are the characteristics of the cement, prices, and a partial list of its many uses.

Sauereisen Cements Co.

**580—Sliding Fire Doors**

Bulletin DHSL-60 describes Dusing & Hunt's new flush design sliding *Pyro-Dor*. This fire door has UL Class "A" 3 hr fire test rating plus lowest heat transmission rating. Built in sectional interlocking panels, these doors have solid mineral core construction. New *PyroMatic* door release.

Dusing & Hunt, Inc.

**581—Tracing Templates**

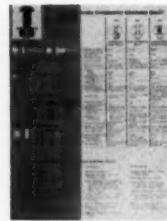
Scale detailed drawings of horizontally hinged *spring-assisted* doors. Complete line includes roof scuttles, smoke hatches, ceiling access doors, floor doors, pit doors, and basement doors with steel stair stringers. Specifications, standard sizes, and weights included. Sales offices in this country and Canada listed.

ILCO Co.

**582—Non-Shrink Mortar**

Bulletin EPMM-4 describes Embeco pre-mixed mortar. This non-shrink mortar is especially formulated for making repairs to cracks, holes, ruts, and worn areas in all types of concrete surfaces. The seven step procedure for repairing damaged areas is covered with complete explanations. Photographs of each step.

Master Builders Co.

**583—High Strength Bearing Bolts**

Engineering bulletin describes new high strength bearing bolt with highest shear strength, greatest resistance to slip of all structural bolts. Advantages in design, in erection, and in structure outlined. Dimensions, comparison data, grip chart. Distributed by all Steel Service Centers of U. S. S. Supply.

Lamson & Sessions Co.

**584—Floor Gratings**

Bulletin covers an improved conception for the installation of floor gratings, using the single-span divider-bar, combined with Borden's Type K reversible grating. Simplifies maintenance as well as installation. Bulletin pictures and describes installation at the new Public Service Generating Station, Linden, N. J.

Borden Metal Products Co.

**585—Underfloor Distribution Systems**

Bulletin 513 contains drawings, part numbers, and photographs of the three *SPANG* duct systems for power, telephone, and intercom. Underfloor duct (for regular slab construction), headerduct (for cellular floors), and industrial duct (large capacity for heavy requirements in phone and intercom systems). Fittings described.

National Supply Co.

To order personal copies of these bulletins

DIRECTORY OF ADVERTISERS' LITERATURE

STRUCTURAL MATERIALS & EQUIPMENT continued



586—Concrete Floor Treatment

Lapidolith, original patented formula for chemically hardening and dustproofing concrete floors, is described in a new 4-page brochure. It shows photographs of actual installations in a variety of industries, specifications, application data, and information on Sonneborn's 3-year minimum bonded guarantee.

Sonneborn Chemical & Refining Corp.



588—Electrified Floor System..

Mahon electrified *Cel-Beam* floor systems designed to safeguard buildings against electrical obsolescence are detailed in this new 16-page bulletin M-58. Use with concrete topping and floor covering, fire resistance ratings, engineering data, dimensions, specifications, and load and property tables are given.

R. C. Mahon Co.



587—Stud Welding Equipment

The Consulting Engineer's file folder contains literature describing the use of Nelson stud welding equipment for concrete anchoring devices and other structural fasteners. Includes data on welded stud fasteners, concrete fasteners, and powder actuated fasteners. Illustrated.

Nelson Stud Welding Division

Gregory Industries, Inc.



589—Slag in Industrial Construction

Bulletin ADUCO-80005 is a full color booklet designed to acquaint the consulting engineer with air-cooled, granulated, and expanded blast furnace slag. This general bulletin discusses slag in foundations, pavements and structures, flooring, railroad ballast, roofing, and flexible pavements. Advantages listed.

U. S. Steel Corp.

WASTE DISPOSAL EQUIPMENT



590—High Capacity Aerator

Bulletin 7316 describes the D-O Aerator for application in both municipal sewage and industrial waste treatment plants. Can be adapted to a variety of tank sizes and is readily incorporated into existing tanks. Cutaways show aerators installed in round tank as well as in rectangular tank. Diagrams show flow.

Dorr-Oliver, Inc.



593—Treatment Tanks

Bulletin AET-59 contains full-color illustrations of water and effluent treatment tanks. They are steel-reinforced concrete structures faced on both sides with vitrified tile laid with corrosion-resistant mortar. Tanks are exceptionally attractive in appearance. Included are drawings showing wall construction.

Stebbins Engineering and Mfg. Co.



591—Waste and Drainage Systems

Engineering handbook on properties and performance of Vulcathene Waste and Drainage Systems. Describes complete range and type of Vulcathene fittings, sinks, traps, and pipe. Contains technical and dimensional data, and engineering drawings. Explains patented *Polyfusion* method for joining Vulcathene fittings.

American Vulcathene Division.



594—Liquid Waste Flow Meter

Bulletin 28 describes the Stevens Model 60M total flow meter. A completely new instrument designed to meet the need for low-cost yet is accurate and dependable. Instrument for measuring the flow of sewage, industrial wastes, or other liquids in open channels. Portability and versatility is featured.

Leupold & Stevens Instruments, Inc.



592—Sewage Lift Stations

Bulletin DJ-60 describes the *Delta-Ject* packaged pneumatic sewage lift station manufactured by Tex-Vit Supply Company, Manufacturing Division. A duplex unit available in 29 to 200 gpm, it features exclusive shell-within-shell design. Bulletin provides engineering data, specifications, and dimensional drawings.

Tex-Vit Supply Co., Mfg. Division



595—Sewage Pumping Station

New full color bulletin 601-A on factory-built sewage pumping stations describes operation, advantages, features of design including Smith & Loveless "Non-Clog" sewage pump. Center spread contains full color cutaway showing operation. Complete engineering data manual on lift stations available.

Smith & Loveless, Inc.

WASTE DISPOSAL EQUIPMENT continued

**596—Sewage Pumps**

Bulletin P10-B26 describes use of the Torque-Flow pump in all phases of sewage treatment operations. Principle of operation and effect are described. Case histories and photographs of actual applications are also included. Cutaway shows construction and operation. Representatives listed.

Western Machinery Co.

**598—Sewage Treatment Plant**

This data manual on the S&L "Oxigest" sewage treatment plant contains notes on design, engineering data, specifications, and installation instructions plus lists of accessory equipment. Now 27 standard sizes; factory-built units for small subdivisions, schools, motels, factories in need of dependable sewage treatment. *Smith & Loveless, Inc.*

**597—Packaged Sewage Pump Stations**

Bulletin PS-60 describes the Tex-Vit packaged sewage pump station. Available in 50 to 2,000 gpm capacities, these are duplex units complete with motors, pumps, controls, dehumidifying unit, corrosion-resistant steel shell, and entrance tube. Bulletin includes engineering data, specifications, and dimensional drawings.

Tex-Vit Supply Co., Mfg. Division

**599—Small Plant Sewage Treatment**

Bulletin 6692 describes Dorr-Oliver equipment for small plant sewage treatment which brings big plant results within the reach of the small community. Bulletin details the plant system; lists its many advantages; gives complete specifications. Photographs show installations and diagrams show equipment.

Dorr-Oliver, Inc.

WATER TREATMENT EQUIPMENT

**600—Water Treatment Plant**

Bulletin 1825 describes the Accelerator water treating plant, its history, operational features, and its many applications in both the municipal and industrial fields. The ABC's of the plant are shown in two-color schematics. Design considerations are listed and explained. Plant layouts and suggested specifications.

Infilco, Inc.

**603—Water Treating Equipment**

Bulletin 615 is a booklet on water treating equipment describing manual and automatic zeolite softeners, mixed-bed and multi-column deionizers, dealkalizers, ion exchangers, filters, purifiers, aerators, and degasitors. Also covers spray and tray type deaerating heaters and water treating chemicals.

Elgin Softener Corp.

**601—Rotary Distributor**

Bulletin B-6001 describes a new rotary distributor for trickling filters which has been introduced by General Filter Co. The GARD distributor is said to have eliminated the seal problem. Three years of tests have proven the units completely non-clogging. Other General Filter water treatment equipment is pictured.

General Filter Co.

**604—Ion Exchangers**

Bulletin 2508B describes Permutit's Ion exchangers for industrial processes in the treatment of water. Schematics show the six types of ion exchange processes. Cutaway shows construction and operation of the automatic demineralizing plant. Other applications are listed and described. Typical installations pictured.

Pfaudler Permutit Inc.

**602—Brinemakers**

Bulletin B160A describes Morton's Model E Series brinemakers using the exclusive Morton Flutron. Function, performance data, installation procedures, and operating instructions are included in this bulletin. Line drawing shows construction and operation. Component parts shown and named. Product photographs. *Morton Salt Co.*

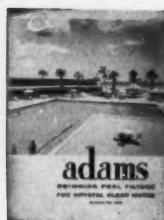
**605—Industrial Diatomite Filters**

Bulletin 2204-R covers a wide range of industrial Diatomite filters, both standard models and custom engineered. Illustrated and described are horizontal plate filters and vertical plate filters. Also shown are Sparkler filters for specialized uses. Cutaway photographs show construction. Specifications given.

Sparkler Manufacturing Co.

To order personal copies of these bulletins

WATER TREATMENT EQUIPMENT continued



606—Swimming Pool Filters

New 24-page technical bulletin for consulting engineers on swimming pool filters for municipal, public, and institutional pools. Contains typical installations, cross-section and operational drawings, charts, and factual comparison. This manufacturer does not offer a filter for backyard type pools.

R. P. Adams Co., Inc.



611—Automatic Water Softener

Simplicity of design in a motorized multi-port valve brings automatic operation within the range of any who need a heavy duty zeolite softener. The Elgin Automatic described in bulletin 616 is available in single unit capacities up to 2,000,000 grains and double units up to 4,000,000 grains.

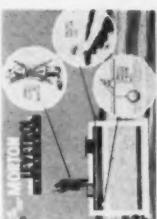
Elgin Softener Corp.



607—Swimming Pool Filters

Catalog 356 describes the *Filtermaster* line of diatomaceous-earth, pressure-type swimming pool filter. Four basic units. Two portable models filter from 1800 to 18,000 gals per hour with multiple units available for any capacity. Bulletin lists advantages, specifications, and explains operation of the *Filtermaster*.

Hopkins Equipment Co.



612—Levelrel System

Bulletin B659P describes a system for wet storage brine-making which proportionately replaces water as brine is withdrawn. Permits accurate salt inventory; prevents overflow loss; eliminates corrosion of moving parts. Line drawings show different types of assemblies for different brine use systems.

Morton Salt Co.



608—Water Gate Hoists

Catalog CH-353 describes gate hoists specifically designed to control water levels on hydro-electric power plant installations. Illustrates some typical hoists. Lists types of stationary and traveling gate hoists and the types of power dam gates for which they are applicable. Capacities from 1 to 100 tons.

D. J. Murray Manufacturing Co.



613—Diatomite Water Filter

Bulletin 670 describes a new type heavy duty diatomite water filter for plant supply water or for filtration of re-use water without appreciable heat loss. Complete description of diatomite, filtration, including engineering specifications. Also gives flow rate charts and table of capacities. Illustration shows construction.

Sparkler Manufacturing Co.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.



614—Diatomite Pressure Filters

Bulletin 2-323 covers the line of Bruner diatomite pressure filters for swimming pools. Standard filters are available in sizes from 12 to 672 sq ft. Features include a septum with interlocking plastic disc core and plastic cloth sleeve. Schematic diagrams and comparison charts for diatomite and sand filters.

Bruner Corp.



615—Water Treatment Products

Bulletin 80-A contains a full list of the products offered by Infilco, Inc. Indexes are provided as a ready reference to the listings of equipment by class, by trade name, and by application. The processes involved in municipal, industrial, sewage, and industrial waste treatment are enumerated. Completely illustrated.

Infilco, Inc.



616—Automatic Control Systems

Bulletin E describes the automation of ion-exchange and water treatment equipment. A suggested specification is included, together with typical illustrations and descriptions of important design features. Automatic control systems described are adaptable to any automatic valve sequencing operation.

Illinois Water Treatment Co.

Fill the card between pages 2 and 3 or 58 and 59

WATER TREATMENT EQUIPMENT continued



617—Diatomite Water Filters

The new Diaqua diatomite filters for pressure and vacuum operation are introduced in bulletin B-6002 by General Filter Co. The completely non-corrosive plastic filter elements insure economy and long life. Precoating, filtering, and cleaning procedures are described with illustrations. Typical installations.

General Filter Co.



618—Water Treatment Equipment

Bulletin 4433 describes Pfaudler Permutit water treatment equipment. Includes information on typical systems, aerators, degasifiers, deaerators, chemical feeders, precipitation equipment, filters, and ion exchange equipment. Charts and tables show impurities, their causes, and methods of treatment. Illustrated.

Pfaudler Permutit Inc.

WHEN YOU TRAVEL



619—Southern Convention Spot

Grand Hotel, with its adjacent Lakewood Golf Club, each year is host to numerous corporation board meetings and sales conferences, as well as to many smaller executive and golfing groups. For those desiring complete information we have a special convention kit. Delightful location, excellent cuisine. *Grand Hotel.*



623—Galveston, Texas

Folder describes Hotel Galvez and Villa located less than one hour drive from Houston via super highway. Thirty mile beach, swimming pool, fishing, horseback riding, tennis and golf are offered for recreation. Completely air conditioned. Facilities of Moody Center available for conventions up to 3500 persons. *Hotel Galvez.*



620—Chicago, Illinois

Folder describes the Acres Motel located at 5600 North Lincoln Avenue on U. S. Route 41 in Chicago Illinois. Accommodations for every taste — single rooms, double rooms, kitchenettes, and apartments. Rooms have individual temperature control. Fine restaurant, swimming pool, and TV. Close to shopping center. *The Acres Motel.*



624—Fort Lauderdale, Florida

Folder describes Rutger's By The Sea in Fort Lauderdale, Florida. Printed in full color, this folder shows deep sea fishing, swimming pool, relaxing areas, and beach facilities. Typical room, lounge, and dining room also shown. Nearby golfing, horse racing, Jai-Alai, and dog racing for entertainment. *Rutger's By The Sea*



621—Mobile, Alabama

Folder describes Hotel Admiral Semmes located in Mobile, Alabama, the Azalea City and one of America's most interesting old cities. A warm and friendly atmosphere and accommodations offer the utmost in comfort and pleasure. Completely air conditioned, television and radio, automobile entrance.

Hotel Admiral Semmes.



625—Point Clear, Alabama

Grand Hotel, Point Clear on Mobile Bay, Alabama, offers colorful booklet on the facilities they provide for the vacationer. An eighteen hole golf course has clubhouse with complete facilities for entertaining. Cruising, fishing, dancing, tennis, and swimming for recreation. Exquisite cuisine and flawless service. *Grand Hotel.*



622—Washington, D.C.

Hotel Washington offers relaxed living. You can drive right into the hotel, via the motor lobby entrance and private registration desk. Dress as you please, your privacy is assured. Smart cocktail lounge, sky terrace, beautifully decorated modern rooms, superb food. Heart of shopping and theatrical districts. *Hotel Washington.*



626—Chicago, Illinois

Folder describes the Acres Motel located on U. S. Route 41 in Chicago, Illinois. A convenient location whether you are headed north, south, or west. A few minutes drive from Chicago's Near North Side and only twenty minutes from the Loop. Swimming pool, TV, fine restaurant, individual temperature controls. *The Acres Motel.*

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